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Editorial

Basic Research: Next to the instinct of self-preservation, the strongest urge in human affairs is curiosity. And when this is harnessed and directed into specified channels of inquiry, we have science. Science is often defined as organised common sense, but pure science is the systematic endeavour to increase our understanding of Nature, without any kind of pre-conceived bias or intention of exploiting the results. It is an intellectual adventure *per excellence*, an explorative expedition into untrodden domains of knowledge. In the good old days of not so long ago, it was quite possible for monied men of leisure to engage themselves in this kind of pure science and make substantial contributions to the sum total of our knowledge regarding the world around us. The names of Sir Issac Newton, Sir Humphrey Davy, Lavoisier, Gregor Mendel and Charles Darwin spring to our minds as shining examples of such research workers.

At present, however, it is extremely difficult, if not impossible, for anyone, however gifted he might be, to make much advance in scientific research, without the aid of public funds. For one thing, our knowledge has progressed so much in so many fields that it is impossible for anyone to build up the requisite foundation of basic principles without devoting eight or ten years and for another, tangible progress in large projects requires regular teams of research workers and involves financial commitments that are possible only from State resources. In recent times industrial concerns have also contributed very large sums towards scientific investigations and depending upon the immediate objectives, research is now divisible into three main types, pure, basic and applied research. Pure research is an inquiry after knowledge for its own sake, with no consideration or hope of practical gain, actuated by an almost abnormal thirst to find out what has not been found out before. Applied research is any investigation carried out in response to immediate, direct and obviously practical needs. As examples we may cite the invention of radar by the British during World

War II and the V2 weapons by the Germans. Basic research comes somewhere in between these two. It is one step (or sometimes even two or three steps) removed from the "pure undiluted thirst for knowledge" even though a good deal of basic research is carried out by scientific workers in faculties of Colleges and Universities. This differs in also another respect from pure research as it is liable to get an occasional nudge and even proddings and goadings from the money-giving agency, to make it move along faster in the desired direction. Human nature being what is, it is only natural for the financing body to feel they have the right to call the tune when they are paying the piper and even to speed up its tempo as well.

The objective in Government aiding scientific research and development is to utilise the practical results arising out of the investigations for the benefit of the nation, but the question has often to be faced as to how far and how much should government funds go into basic research in proportion to applied research.

One possibility which has not been hitherto tackled satisfactorily, anywhere in the world except perhaps in the U. K. and the U. S. A., is that funds are to be sanctioned by a body of persons who might have no touch with the field of study in question, so that they would naturally tend to favour the sanction of funds only to such items as appear to have a practical utility in the view of the sanctioning body.

To safeguard against such a possibility, it is necessary to recognise the principle that basic research is quite as essential as applied research for progress in scientific advancement. Sufficient funds should be made available to Universities and Research Institutes on a long-term basis. In an enlightened national organisation there will be no need to advance arguments to convince the persons controlling the allocation of funds regarding the need for furthering basic research, because in the tree of scientific achivement pure research forms the root-system, basic research the main stem and applied research the smaller branches and leaves. And it is needless to stress the fact that the trunk is quite as important as the twigs and leaves.

The Influence of Drying on the Germination of Seed Arecanuts (*Areca catechu* L.)

by
SHAMA BHAT KHANDIGE

Introduction: The importance of arecanut industry in the economy of the country has been recognised only recently. Except undertaking certain measures for combating some important diseases of the palm, very little work has been done regarding the fundamental breeding or agronomic aspects of this crop, though it occupies a total area of about 2,60,000 acres.

Amongst the agronomic practices followed in the cultivation of this crop, the treatments given to the seeds before sowing is observed to be of considerable importance. The seed arecanuts are usually partially dried before sowing or allowing them to germinate. It is not known if it is really essential to dry the nuts or to give a sort of dormancy period before sowing them, to get a successful germination. It is also believed that partial drying of nuts helps to disintegrate the husk at a later stage (when the nuts are irrigated) and ensures easy emergence of sprouts. Hence, with the object of determining the necessity or otherwise of partial drying of nuts to get successful germination of nuts, an experiment was conducted. The data collected and the results achieved are presented in this paper.

Review of Literature: Literature on this subject seems to be meagre. However, Nambiar (1949), Coleman and Venkata Rao (1918) and Yegnanarayana Iyer (1944) have mentioned that the arecanuts are dried before sowing. They have not mentioned the reasons for drying the arecanuts. To quote Sri K. K. Nambiar, the agronomic practices of areca are still "primitive, affording considerable scope for improvement of its cultivation."

Material and Methods: The trial was conducted for a period of five months commencing from January 1955, at the Arecanut Research Station, Vittal, South Kanara district. Seed nuts were selected from healthy trees of regular and good yielding nature. Bunches which were almost uniformly ripe and from which ripe nuts had begun to drop were selected and the nuts selected for the trial were from the middle portion of the bunches. Immediately after separation of the nuts from the bunches they were dipped in cattle-dung solution. Sowings were commenced from the day of

harvest up to after 21 days of drying. The nuts were dried by spreading them under a pandal. From each bunch 110 nuts were selected and ten nuts of each were sown on every alternate day, thus sowings were done on 11 days. Each day's sowing was done in separate rows and a uniform spacing was maintained throughout giving three inches between nuts along rows which were one foot apart. The nuts were dibbled with their top (or calyx) ends pointing upwards and level with the surface of soil. The experiment was repeated five times by obtaining nuts from 5 bunches of 5 different trees. Watering was done immediately after sowing by using a rose-head can daily, except during rainy days and it was ensured that the ground was kept continuously moist but without stagnant water at any time. The observation of the number of nuts germinated in each row was made on alternate days. The data regarding the number of days required for germination of the nuts sown on different dates and the percentage of nuts germinated in each group are given in the tables.

The following conclusions may be drawn from the data set out in the tables.

1. Cent per cent germination of seed arecanuts was obtained from those which have been sown either immediately after harvest or sown after one day's drying.

2. Drying of arecanuts does not seem to increase the capacity of nuts to germinate.

3. Seed-nuts obtained from the same bunch itself required varying number of days for germination under identical conditions.

4. Germination commences from about 47 days after sowing and extends up to 81 days after sowing. The average number of days required for germination is 63.

Discussion: From the enquiries made by the author and also as reported by Nambiar and Coleman it is known that drying of arecanuts for varying number of days before sowing is almost a universal practice. It is believed by some that successful germination could be obtained only by partial drying of arecanuts required a sort of dormancy period. With the object of finding out the necessity to dry arecanuts before sowing, the above experiment was conducted and the results go to show that it is not necessary to dry arecanuts before sowing. It was also observed from the morphological point of view that the seedlings that have come up

TABLE I

Percentage of nuts germinated (sown on different dates)

Replications	Date of sowing											Mean
	31—1—55	2—2—55	4—2—55	6—2—55	8—2—55	10—2—55	12—2—55	14—2—55	16—2—55	18—2—55	20—2—55	
I	100	100	90	100	90	100	100	100	100	80	60	92·7
II	100	100	100	90	100	90	70	80	50	60	Nil	76·3
III	100	100	100	100	100	100	100	100	100	100	80	98·2
IV	100	100	100	100	100	100	100	100	90	80	60	93·6
V	100	100	100	100	100	100	100	100	100	50	60	91·8
Mean	100	100	98	98	98	98	94	96	88	74	52	—

TABLE II

Number of days after sowing required for germination of nuts sown on different dates

Sowing No. and Date	(Replication) I			II			III			IV			V			Mean		
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.
1. (31—1—55)	57	77	67	63	73	68	61	67	64	57	73	65	57	65	61	59·0	71·0	65·0
2. (2—2—55)	59	79	69	55	71	63	63	73	68	59	75	67	55	75	65	58·2	74·6	66·4
3. (4—2—55)	59	77	68	57	67	62	57	73	65	53	73	63	55	73	64	56·2	72·6	64·4
4. (6—2—55)	55	77	66	57	71	64	57	75	66	53	71	62	53	63	58	55·0	71·4	63·2
5. (8—2—55)	53	73	63	59	71	65	53	63	58	49	59	54	49	63	56	52·6	65·8	59·2
6. (10—2—55)	53	57	55	53	63	58	53	71	62	47	67	57	49	57	53	51·0	63·0	57·0
7. (12—2—55)	53	65	59	53	65	59	51	57	54	57	61	59	49	63	56	52·6	62·2	57·4
8. (14—2—55)	51	59	55	55	67	61	51	59	55	57	69	63	51	67	59	53·0	64·2	58·6
9. (16—2—55)	51	67	59	61	81	71	51	67	59	61	77	69	53	65	59	55·4	71·4	63·4
10. (18—2—55)	47	67	57	51	71	61	59	67	63	63	75	69	55	69	62	55·0	69·8	62·4
11. (20—2—55)	49	65	57	Nil	Nil	Nil	57	67	62	63	75	69	55	67	61	56·0	68·5	62·2

from the nuts that have not been dried are not inferior to the seedlings obtained from those obtained from dried nuts. Hence it can be concluded that the drying of arecanuts before sowing is not necessary to get good areca seedlings. Even though the experiment was primarily intended to correlate the germination capacity of arecanuts with drying, the trial was further utilised to get a correct idea of the number of days required for the nuts to germinate. The fact that only 52 per cent of the nuts that have been dried for over 21 days have germinated, gives an indication that they begin to lose their viability after a certain stage of drying. However, since the ultimate aim of any experiment is only the yield per tree, it is quite necessary also to see and compare how these seedlings obtained from nuts of different stages of drying will fare when they begin to yield.

Summary: With a view to find out whether it was essential to dry ripe arecanuts before sowing to get a good germination, an experiment was conducted by sowing ripe arecanuts after drying for different number of days. The results obtained go to show that it is not necessary to dry arecanuts before sowing at all and the germination started after about 47 days of sowing. The process of germination continued up to 81 days.

Acknowledgment: The author is grateful to the Indian Central Arecanut Committee for having partly financed a scheme under whose auspices this work was carried out. He also wishes to express a deep sense of gratitude to Sri M. Kandaswamy, Government Mycologist, under whose guidance this work was done and to the members of the staff of the Arecanut Research Station, Vittal, for their kind co-operation in recording observations.

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Calopogonium for Control of Weeds in Coconut Gardens

by

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One of the important problems that confront the coconut grower, is the eradication of weeds in his garden. In competing with the coconut, the weeds utilise a considerable amount of plant food and soil moisture for their own growth, thereby lessening the available supply to the coconut trees, and consequently reducing their yield to an appreciable extent. Coconut is unique in that when it begins to yield, it produces nuts all through the year, unlike many other perennials and continues its productive phase almost to its entire life period of 70–80 years. Coconut plantations in general are not manured adequately and it becomes all the more essential to make the limited plant food available reach the main crop by eliminating the unwanted weeds which deprive the palm of a fair share of its requirements.

The subject of weed control in agricultural and horticultural cropping has engaged the attention of growers for a long time. The most common and universal practice adopted in controlling weeds is the mechanical method of uprooting the weed and destroying them. In annual crops this operation is a regular feature and periodical hoeing and weeding are included in the schedule of operations given to any particular crop. The crops are on the field for a few months from sowing to harvest and as such this method of eliminating weeds is quite effective and does not add unduly to the cost of production of the crop. Other practices that are in vogue to suppress weeds are burning leaves and rubbish spread over the ground to destroy the viability of weed seeds in the soil, scything before the weeds set seed, mulching, growing cover crops, spreading chemicals and spraying weedicides on the weed population. One or more of these measures are effective with varying degrees of success, but all the same they add to the cost of cultivation of the crop, which an ordinary ryot can ill afford to spend. The knowledge on weed control has so much advanced in the United States of America, that considerable sums are being spent for controlling weeds by the application of weed

killing chemicals to the soil or spraying on the weed vegetation. The figures for 1951 from U. S. A. reveal that 112 million pounds of phenoxyacetic acid derivatives alone have been consumed for weed killing purposes.

In plantation crops like coffee, tea, rubber, cardamom and oranges, the weed growth gets checked to an appreciable degree due to the shade provided by the growing trees or bushes and also by the mulch resulting from the shed leaves, which are allowed to accumulate in the plantations. Such a system was observed in the coconut groves in Car Nicobar in the Nicobar group of Islands. Here the coconut plantations, unlike those elsewhere, are thickly populated and the leaves, husks and other vegetable matter are allowed to accumulate on the surface soil of the plantations, the mulch thus formed inhibiting the growth of weeds. Besides adding to the humus content of the soil, it is also observed that the mulch suppresses weeds successfully. In the coconut gardens on the West Coast, however, the trees are spaced far apart and no leafy mulch is possible, as the few shed leaves are periodically removed and used for other purposes. Thus weed growth remains unchecked. Further, as the palms grow older, the application of manures aided by the high and continuous rainfall spread over a period of nearly six months from May to October every year, creates conditions which are very conducive to the spread of weeds. It is said that 'one year's seeding requires seven years' weeding'. Once the removal of the weeds is neglected, it becomes a difficult and costly item to eradicate them, as they take a permanent footing and rob the valuable plant nutrients, which would otherwise be available to the main crop. The weeds that are commonly met with in coconut gardens are the various grasses, *Hyptis*, *Mimosa pudica* and other herbaceous undergrowth, which thrive under the humid West Coast conditions.

In perennial crops like the coconut, which is on the field for a number of years, the eradication of weeds as done in annual cropping is not always a practicable proposition and is also expensive, considering the area that has to be tackled and the greater frequency of the control measures for visual results. It therefore becomes apparent that a cheap as well as effective control measure that can easily fit into any of the normal cultural or manurial operations given to the plantation, is very necessary.

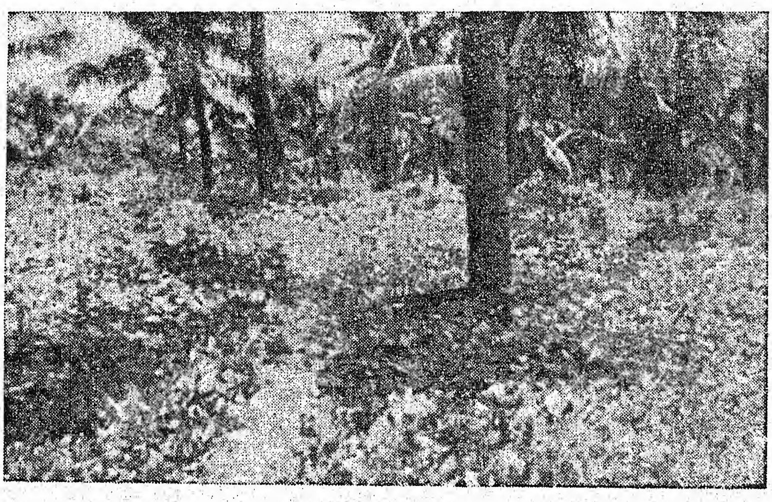
It has been established from experiments in the Coconut Research Stations on the West Coast that regular cultivation of

coconut gardens increases the yield of trees to a remarkable extent and also minimizes the fluctuation in yield due to adverse seasonal conditions. Conservation of soil moisture in the dry season is ensured by such a practice. It has also been demonstrated that systematic manuring and incorporation of a green manure crop increases the yields. Jagoe R. B. (1939) has stated that experiments in Malaya have shown that growing of a cover crop of *Centrosema pubescens* checks the growth of *Lalang* grass and improves the yield of trees. Sampson (1923) has recorded that growing of a cover crop is beneficial to the coconut trees, but the choice of the crop should be such that it should not continue growing in the dry season and compete with the coconut for the limited supply of soil moisture in that period.

Such a crop is found in *Calopogonium mucunoides*, a green manure-cum-cover crop for coconut gardens, which has been raised successfully in the Coconut Research Stations at Pilicode and Nileshwar for ths last two years. The way in which this crop with its quick growth and rapid spread of entwining foliage, makes it almost impossible for any weed to grow underneath, within a period of three months after germination, is really astonishing. The crop has been raised both as a self-sown and a sown crop. The rate of growth is quicker in the self-sown crop than the sown crop, but in either case it attains sufficient growth and spread to inhibit the progress of the weeds underneath. Besides this, the crop also gives an outturn of 10,000 to 20,000 lb. green leaf per acre. It acts as an effective cover to prevent soil erosion and dries up in summer, leaving a thick dry mulch 4–6 inches thick. This protective mulch conserves soil moisture, reducing the evaporation during the rainless summer months.

The method of raising *Calopogonium* as a green manure cum-cover crop and also as a means of controlling weeds in coconut gardens is indicated below. The land is ploughed once in April-May just after the receipt of summer showers. Seeds of *Calopogonium* are broadcast, using a seed rate of 8–15 lb. per acre and covered by working a cultivator or Junior Hoe. The seeds will germinate after soaking showers and by the time the South-West monsoon sets in, the plants would have grown sufficiently to cover the ground. Thereafter the vegetative growth increases and within a period of three months after germination, the entire surface area of the field is covered by this legume, the weeds and grass being smothered to a remarkable extent. From now onwards, there is little chance for

the weeds to grow any further, as the thick mass of entwining foliage suppresses them. The crop flowers in October–November and dries up in December–January. The dried leaves form a layer of 4–6″ thick mulch, providing a protective screen against the severe heat of the summer sun. Just before the receipt of summer showers in April in the following year, the mulch should be broken by ploughing the area, which will ensure proper germination of the self-sown seeds. The seeds will germinate with the receipt of soaking showers and the crop will thus continue its useful service to the coconut.

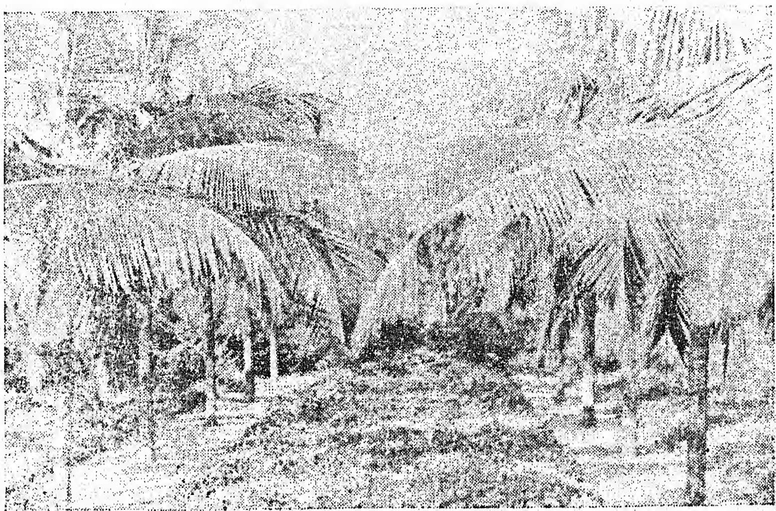


PICTURE I

Three months' old crop of *Calopogonium mucunoides* in Block VIII of Coconut Research Station, Nileshwar II. See how the weeds are smothered by the thick growth of legume.

One significant aspect to be considered while raising this crop in a coconut garden is the fitting in of cultural and manurial operations, which are as important as growing a cover crop for the coconut. This can be done successfully by adopting either of the following two methods. (1) A strip of four feet width on either side of the rows of coconut trees is dug with the mammutty in August-September. The required manures may be applied in this 8 feet wide strip and further digging given as and when necessary. Thus the tree will continue to receive the benefit of the cover crop as well as the cultural and manurial treatments. (2) The second method is to plough the green manure crop in August–September in the alternate interspaces between rows of trees.

This will facilitate the scheduled cultural and manurial operations to be done in alternate interspaces, the crop in the unploughed plots to be retained as, a mulch and allowed to set seeds. Soon after the setting of seeds one lopping can be given and the lopped material spread over the ploughed area. Thus the whole field gets the mulch in the summer months. Just after rains are received in April, the entire field is ploughed to incorporate the green manure and cover the shed seeds. By adopting this method, the coconut trees get the good effect of the green manure, mulch and a self-sown crop in the next season without losing the advantage of cultural and manurial operations.



PICTURE II

For facilitating cultural operations, note how a strip of 8 feet is dug, leaving the remaining area covered by the Calopogonium crop.

Thus, with very little extra cost, a good crop of *Calopogonium mucunoides* can be grown as a green manure-cum-cover crop in coconut gardens and in about three months after germination this crop suppresses weed growth effectively. It provides an economical and practical method of controlling weed growth in coconut plantations. The crop can also be fitted in with the normal manurial and cultural operations so necessary in a coconut garden; at the same time it yields plenty of organic matter, serves as a cover crop to prevent soil erosion and also provides a mulch during the summer months to conserve soil moisture. Its cultivation is within the means of an average coconut grower and it is hoped that a fair

trial for this leguminous crop will be given in the coconut plantations on the West Coast.

Acknowledgment: The authors are grateful to Sri M. S. Sivaraman, I. C. S., Director of Agriculture, Madras at whose instance the crop was introduced at the Stations and was grown successfully. They are also thankful to Sri C. R. Seshadri, Oilseeds Specialist, Coimbatore, for his helpful suggestions and advice rendered from time to time.

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Errata

(Review of Market Conditions of Commercial Crops in the areas of Market Committees for November, 1955, published in the December 1955 issue of the Madras Agricultural Journal).

Page No.	Line No.	Correction
554	18	505 instead of 5,050
554	20	2,070 instead of 2,075

558 Under disposal column in the I statement at Mangalore read 265 instead of 375.

558 Under opening balance column in the II statement at Kozhikode read 1,333 instead of 1,833.

Under disposal column in the, same statement at Badagara read 1,470 instead of 1,476.

Under closing balance column in the statement at Mangalore read 38 instead of 39.

559 Under disposal column in the II statement at Kozhikode read 3,098 instead of 3,089. In the same statement at Ponnani read 2,800, 1,500, 2,500 and 1,800 respectively for 696, 1,510, 1,088 and 388.

Quantity mentioned as cwt. opposite to Ponnani under Arecanut may be read against Mangalore.

560 Third line under Tobacco read candies instead of days.

Studies on the Inheritance of some Anthocyanin and Corolla Colour Characters in Asiatic Cotton

by

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Introduction: From a crop survey of the Peninsular Indian *arboreum* cottons in the Cocanadas (race *indicum*) zone, Balasubramanyan, Ramaswamy and Jagannatha Rao (1946) reported on the occurrence of three new genotypes not recorded earlier in this region. They were (a) Green stem/Ghost Spot – R_2^{os} R_2^{os}; (b) Fully immature lint – *lm* and (c) Incomplete boll dehiscence – de_b and the inheritance of these characters in a few combinations of crosses has since been reported by Balasubramanyan *et al* (1950).

The Green stem/Ghost Spot type was characterised by the complete absence of anthocyanin pigment in all plant parts and by the presence of a white patch in the place usually occupied by the red spot in the petal. The corolla colour of the new type was yellow and hence the white patch designated as 'Ghost' (Hutchinson, 1932) was easily visible. The inheritance of this Green stem/Ghost spot complex in relation to different anthocyanin and corolla colour factors, in five inter-racial crosses in *G. arboreum* involving Sun-red and Deep-red; Yellow corolla, Pale-yellow and White corolla genotypes is reported in this paper.

Previous Work: (i) *Anthocyanin organisation:* The anthocyanin genetics of cotton has been the subject of detailed study by Hutchinson (1932) and Silow and Yu (1942). Yu (1932); Yu and Hsi (1934); Hutchinson and Ghose (1937); Ramiah and Bholanath (1944) and Balasubramanyan *et al* (1950) have also reported on the occurrence of newer members of the anthocyanin multiple allelmorph series in Asiatic cottons or established homology of new mutants with known genes. A survey of anthocyanin organisation in cotton has also been recently made by Ramiah (1945).

In Asiatic cottons, the distribution of anthocyanin pigment in the vegetative parts of the plant and on the flower petal is known to be controlled by the R_2 series of multiple allelmorphs, of which at least twenty members have now been established (Stephens and Cassidy, 1946). The extent and intensity of pigmentation of the plant body and the presence or absence of petal spot constitute the two main attributes of the anthocyanin system.

In such diverse organs and locations as stem, petiole, leaf pulvinus, leaf veins, leaf lamina, bracts, calyx, bolls, anther, filaments, petal, lamina and petal edge, anthocyanin finds expression and on the basis of vegetative anthocyanin, three groups viz. 'Green', 'Dilute red' or 'Sun-red' and 'Deep red' can be made out. With regard to the other attribute viz., the presence or absence of petal spot, three phenotypes are recognised viz. 'Red spot', Ghost spot' and 'Spotless'. 'Ghost' has a white spot in the place usually occupied by red spot in the petal, while in the case of 'Spotless', no spot is present. Excepting in the case of 'Ghost', which occurs only in the 'Green' class, Red spot' and 'Spotless' forms exist in all the three classes of vegetative anthocyanin viz. 'Green', 'Dilute red' and 'Deep red'.

(ii) *Corolla Colour Genetics:* Three main Corolla Colour types occur in Asiatic cottons viz., Yellow, Pale Yellow and White. Hutchinson (1931) showed that the inheritance of corolla colour in Asiatic cottons was controlled by a multiple allelomorph series at the Y_a locus (Gene symbol. after Hutchinson and Silow, 1939). Subsequent additions to this series were the 'Chinese Pale' at the Y_b locus and 'Anomalum Pale' at the Y_c locus (Silow, 1941). Bholanath (1942) let in confirmatory evidence for the complementary nature of Y_a and Y_b Loci for production of Yellow corolla.

Recently, Stephens (1954) has reviewed the position and summed up the situation as follows:

Type	Genotype	Phenotype	Distribution
1. Yellow	Ya Yb Yc	Yellow	*G. arboreum* and *G. herbaceum*
2. Common pale	Ya^{P} Yb Yc	Uniformly pale	*G. arboreum* only
3. Chinese pale	Ya Yb^{P} Yc	Pale, with intensification around throat of Corolla	Chinese strains of *G. arboreum* only
4. Anomalum pale	Ya Yb Yc^{P}	Uniformly pale	*G. anomalum*
5. White	Ya Yb Yc	White	*G. arboreum*

Material and Methods: The present studies relate to crosses of the Cocanadas Green stem/Ghost spot, Yellow corolla type with 1) Sun-red spot, Yellow corolla; 2) Sun-red/Red spot, Pale yellow Corolla; 3) Sun-red/Red spot, White corolla; Deep red/Spotted, red on Yellow corolla; and 5) Deep red/Spotted, red on white corolla types in *Gossypium arboreum*. The characteristics of the parents used in the study are furnished in table 1.

TABLE I

Characteristics of parents used in the study

S. No.	Type	Botanical classification	Authocyanin	Corolla Colour	Genotype
1.	CST 3	*G. arboreum* race *indicum*	Green stem/Ghost	Yellow	$R_2^{OS}\ R_2^{OS}\quad Ya\ Ya$
2.	Burma C 19	*G. arboreum* race *burmanicum*	Sun-red Spotted	Yellow	$R_2^{AS}\ R_2^{AS}\quad Ya\ Ya$
3.	Cernuum	*G. arboreum* race *cernuum*	Sun-red Spotted	Pale Yellow	$R_2^{AS}\ R_2^{AS}\quad Ya^{P}\ Ya^{P}$
4.	N. R. 5	*G. arboreum* race *bengalense*	Sun-red Spotted	White	$R_2^{AS}\ R_2^{AS}\quad Ya\ Ya$
5.	Sanguineum 119	*G. arboreum* race *bengalense*	Full-red Spotted	Red on Yellow	$R_2^{RS}\ R_2^{RS}\quad Ya\ Ya$
6.	Sanguineum major	*G. arboreum* race *bengalense*	Full-red Spotted	Red on White	$R_3^{RS}\ R_2^{RS}\quad Ya\ Ya$

The following five combinations of crosses were effected and observations made on the F_1, back crosses and F_2 populations.

1. CST. 3 x Burma C 19 ... (*indicum* x *burmanicum*)
2. CST. 3 x Cernuum ... (*indicum* x *cernuum*)
3. CST. 3 x N. R. 5 ... (*indicum* x *bengalense*)
4. CST. 3 x Sanguineum 119 ... (*indicum* x *bengalense*)
5. CST. 3 x Sanguineum major (*indicum* x *bengalense*)

Phenotypic classification in respect of pigmentation of plant parts and corolla colour in the yellow x pale yellow and yellow x white crosses, was made on the basis of visual scoring. In the case of crosses involving interaction of the deep red (anthocyanin genotype on corolla colour expression, colour plates of Hutchinson (1932) were utilised for grading. Freshly opened flowers were used for classification of corolla colour and petal grading was done with flowers on the plant, in the early period of the day before fading set in.

In analysing the results of segregation, the *Chi* square test was applied to test the goodness of fit to expected ratios and probability determined.

In dealing with the interaction of anthocyanin and corolla colour genotypes, tne R_2^{os} segregants have been left out since only in the R_2^{RS} back ground is the expression of the corolla colour gene modified.

Results and Discussion: The data relating to the inheritance of anthocyanin, inheritance of corolla colour, anthocyanin—corolla colour combined assortment and interaction of genotypes on the expression of corolla colour are presented below and discussed under the respective heads.

(i) *Inheritance of anthocyanin:* The anthocyanin system in Asiatic cottons has two main attributes viz., the pigmentation of plant parts and the presence of petal spot. The results of segregation in the five crosses involving the Green stem/Ghost spot type on the one hand with three Sun-red/Red spotted and two Full red/Red spotted types are furnished in Table 2.

TABLE II

Inheritance of anthocyanin (Petal spot)

S. No.	Nature of cross and germination	No. of plants with		Total	Monogenic segregation	
		Pigmented/ Red spot	Green stem/ Ghost spot		*Chi*^{2}	Value of P. between
1.	CST. 3 x BC 19	F_1 33	..	33	..	..
	Back cross with CST.3	49	44	93	0·269	0·50 — 0·70
	Back cross with BC. 19	102	..	102	..	..
	F_2 Total of 6 families	276	84	360	0·266	0·50 — 0·70
2.	CST. 3 x Cernuum	F_1 32	..	32	..	..
	Back cross with CST. 3	58	52	110	0·328	0·50 — 0·70
	Back cross with Cernuum	98	..	98	..	..
	F_2 Total of 4 families	299	99	398	0·003	0·95 — 0·98
3.	CST. 3 x N. R. 5	F_1 37	..	37	..	..
	Back cross with CST. 3	35	34	69	0·014	0·80 — 0·90
	Back cross with N. R. 5	26	..	26	..	..
	F_2 Total of 7 families	199	73	272	0·491	0 30 — 0·50
4.	CST. 3 x Sanguineum 119	F_1 20	..	20	..	..
	Back cross with CST. 3	66	50	116	2·206	0·10 — 0·20
	Back cross with Sanguineum	55	..	55	..	..
	F_2 Total of 3 families	191	68	259	0·217	0·50 — 0·70
5.	CST. 3 x Sanguineum major	F_1 8	..	8	..	..
	Back cross with CST. 3	79	97	176	1·840	0·10 — 0·20
	Back cross with Sanguineum major	52	..	52	..	..
	F_2 Total of 3 families	232	80	312	0·068	0·70 — 0·80

Cross 1: CST. 3 x Burma C. 19 (*indicum* x *burmanicum*)
Green stem/Ghost x Sun-red/Red spot.

The F_1 was observed to be Sun-red/Red spot and in the back-cross with the recessive parent, Green stem/Ghost, segregation was obtained in the ratio of 1 : 1 for the two phenotypes. The segregation in F_2 also accorded well with expectations on the basis of monogenic inheritance.

Cross 2: CST. 3 x Cernuum (*indicum* x *cernuum*)
Green stem/Ghost x Sun-red/Red spot.

In this cross also, Sun-red/Red spot was dominant over Green stem/Ghost and the segregation in backcrosses and F_2 conformed to monogenic inheritance.

Cross 3: CST. 3 x N. R. 5 (*indicum* x *bengalense*)
Green stem/Ghost x Sun-red/Red spot.

The F_1 was again Sun-red/Red spot and a good fit for 3 : 1 segregation of Spot: Ghost in F_2 and 1 : 1 segregation in the back cross with the recessive parent CST. 3 was obtained.

Thus, in all the above three inter-racial crosses within *G. arboreum*, the Cocanadas Green stem/Ghost has proved to be a simple recessive to the Sun-red/Spotted types, confirming previous behaviour of the Green stem/Ghost (R_2^{OS}) allele in other crosses with the Sun-red spotted (R_2^{AS}) allele.

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
Green stem/Ghost x Full red/Red spot.

The Sanguineum 119 parent carries the R_2^{RS} allele, the deepest member of the anthocyanin series and this was dominant over the Green stem/Ghost R_2^{OS} genotype in the F_1. In the back cross with recessive parent, the segregation gave a good fit to 1 : 1 ratio for the two phenotypes, while in the F_2, Spot and Ghost were inherited in the ration of 3 : 1.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*)
Green stem/Ghost x Full red/Red spot.

The Sanguineum major parent also carries the R_2^{RS} allele, but differs from the Sanguineum 119 parent only in respect of its corolla colour genotype.

The behaviour of the F_1, back crosses and F_2 in this cross was similar to that of Sanguineum 119 cross in respect of anthocyanin inheritance.

The Cocanadas Green stem/Ghost which carries the R_2^{OS} allele of the anthocyanin multiple allelomorph series has thus confirmed its behaviour, as a simple recessive to the R_2^{AS} and R_2^{RS} alleles in the inter-racial crosses studied now.

(ii) *Inheritance of Corolla colour:* The CST. 3 Green stem/Ghost type possesses Yellow corolla and the inheritance of the same in crosses with Yellow corolla (Burma C 19); Pale yellow corolla (Cernuum); White corolla (NR5); Red on Yellow corolla (Sanguineum 119) and Red on White corolla (Sanguineum major) types is summarised in table 3.

Cross 1: CST. 3 x Burma C. 19 (*indicum* x *burmanicum*)
Yellow x Yellow.

In this cross between two Yellow corolla types, the F_1 was Yellow and in the back crosses and F_2, all the plants possessed Yellow corolla, thus confirming that both the parents carried the Y_a allele.

Cross 2: CST. 3 x Cernuum (*indicum* x *cernuum*)
Yellow x Pale Yellow.

In the F_1, yellow corolla colour was dominant over pale yellow and in the back cross with CST. 3, all the plants were yellow. In the other back cross viz., with the recessive Pale yellow parent, 1:1 segregation for the two phenotypes was obtained. The F_2 segregated in the ratio of 3:1 for yellow and pale yellow corolla types, respectively.

The cernuum parent is known to carry the $Y_a{}^P$ allele and its behaviour as a simple recessive to Y_a carried by the CST. 3 parent is confirmed.

Cross 3: CST. 3 x N. R. 5 (*indicum* x *bengalense*)
Yellow x White.

In the F_1, all plants possessed yellow corolla and in the back cross with CST. 3 all the plants were yellow. In the other back cross with the recessive white corolla parent, the segregation for yellow and white corolla plants gave a good fit to 1:1 expectation. In the F_2, the proportion of plants in the two phenotypes conformed to a 3:1 segregation.

The N. R. 5 parent is known to carry the y_a allele and the behaviour of the same as a simple recessive to Y_a of the CST. 3 parent is confirmed.

TABLE III

Inheritance of Corolla Colour

S. No.	Nature of cross and generation	No. of plants with corolla: Yellow	Pale Yellow	White	Total	Monogenic segregation: X^2	Value of P. between
1.	CST. 3 x BC. 19	F_1 33	..	..	33	..	..
	Back cross with CST. 3	93	..	..	93	..	..
	Back cross with BC. 19	102	..	..	102	..	..
	F_2 Total of 6 families	360	..	..	360	..	..
2.	CST. 3 x Cernuum	F_1 32	..	..	32		
	Back cross with CST. 3	110	..	..	110	..	..
	Back cross with cernuum	56	42	..	98	2·000	0·10 — 0·20
	F_2 Total of 4 families	304	94	..	398	0·404	0·50 — 0·70
3.	CST. 3 x N. R. 5	F_1 37	..	..	37		
	Back cross with CST. 3	69	..	..	69	..	..
	Back cross with N. R. 5	16	..	10	26	1·384	0·20 — 0·30
	F_2 Total of 7 families	205	..	67	272	0·020	0·80 — 0·90

S. No.	Nature of cross and generation	No: of plants with corolla: Red on yellow	Yellow	Red on white	White	Total	X^2	Value of P. between
4.	CST. 3 x Sanguineum major	F_1 20	..	..	..	20		
	Back cross with CST. 3	66	50	..	..	116	2·206	0·10 — 0·20
	Back cross with Sanguineum 119	55	..	..	..	55	..	..
	F_2 Total of 3 families	191	68	..	..	259	0·217	0·50 — 0·70
5.	CST. 3 x Sanguineum major	8	..	..	..	8	..	..
	Back cross with CST. 3	79	97	..	..	176	1·840	0·10 — 0·20
	Back cross with Sanguineum major	31	..	21	..	52	1·924	0·10 — 0·20
	F_2 Total of 3 families	176	68	56	12	312	4·536	0·20 — 0·30

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
Yellow x Red on Yellow.

The corolla colour genotype of the Sanguineum 119 parent is Y_a, but due to the inter-action of the anthocyanin allele R_2^{RS}, the phenotypic expression is 'Red on Yellow'. In the F_1, the corolla colour was 'Red on Yellow' due to dominance of R_2^{RS} over R_2^{OS} (CST. 3 parent). In the back cross with CST. 3, segregation was obtained in the ratio of 1:1 for Red on Yellow: Yellow corolla plants. In the other back cross viz., with Sanguineum 119, all the plants possessed 'Red on Yellow' corolla. The segregation in F_2 conformed to 3:1 expectations for 'Red on Yellow': Yellow corolla plants.

Although this cross represents one between two types both carrying Y_a, due to the differences in their anthocyanin genotypes viz., R_2^{RS} and R_2^{OS}, phenotypic segregation for corolla colour was obtained and the same was identical with that of anthocyanin segregation. The intensity of anthocyanin expression on the yellow corolla background was also studied in the different R_2^{RS} segregants as per standard grades and these results are presented and discussed in a separate section.

Cross 5: CST. x Sanguineum major (*indicum* x *bengalense*)
Yellow x Red on White.

The Sanguineum major parent carries the recessive y_a allele for corolla colour and the phenotypic expression of this white corolla gene is 'Red on White' in the background of R_2^{RS}, the anthocyanin allele carried by Sanguineum major.

The F_1 was 'Red on Yellow' due to the Y_a allele inherited from the CST. 3 parent. In the backcross with this parent, segregation for the F_1 and parental phenotypes was obtained in the ratio of 1:1. In the backcross with the other parent viz., Sanguineum major, segregation for the F_1 and the parental phenotypes gave a good fit to 1:1 segregation. In the F_2, the phenotypic classes were 'Red on Yellow', Yellow, 'Red on White' and White corolla and and the segregation conformed to expectations on a 9:3; 3:1 hypothesis.

Although this cross represents one between two alleles viz., Y_a and y_a, so far as corolla colour is concerned, four phenotypic classes have been obtained in the F_2 due to the interaction of the

R_2^{RS} anthocyanin allele on corolla colour expression. The grades of corolla colour segregation in this cross is dealt with in a subsequent section of this paper.

(iii) *Corolla Colour — Anthocyanin combined assortment:* The crosses involved in the present study include three anthocyanin genotypes in the R_2 series of multiple allelomorphs and three corolla colour genotypes in the Y_a series of alleles.

The data relating to corolla colour—anthocyanin combined assortment in the five crosses studied are presented below.

Cross 1: CST. 3 x Burma C. 19 (*indicum* x *burmanicum*) Yellow corolla/Green stem — Ghost x Yellow corolla/Sun-red, spotted.

Since both the parents carry the Yellow corolla gene Y_a, there was a segregation only in respect of anthocyanin, the results of which have been presented earlier.

Cross 2: CST. 3 x Cernuum (*indicum* x *cernuum*) Yellow corolla/Green stem—Ghost x Pale yellow corolla/Sun-red, spotted.

This represents a cross between $Y_a\ Y_a\ R_2^{OS}\ R_2^{OS}$ and $Y_a^P\ Y_a^P\ R_2^{AS}\ R_2^{AS}$. The F_1 was phenotypically $Y_a\ R_2^{AS}$ (Yellow corolla/Sun-red, spotted) and the results of segregation in F_2 and back crosses are presented in table 4(a).

Cross 2: CST. 2 x cernuum: Yellow corolla/Green stem, Ghost x Pale yellow corolla/pigmented-red spot.

It would be seen that the results of combined assortment accord well with expectations on the basis of independent dihybrid segregation for corolla colour and anthocyanin.

Cross 3: CST. 3 x N. R. 5. (*Indicum* x *bengalense*) Yellow corolla/Green stem-Ghost x White corolla Sun-red, spotted.

This is a cross between $Y_a\ Y_a\ R_2^{OS}\ R_2^{OS}$ and $Y_a\ Y_s\ R_2^{AS}\ R_2^{AS}$. The F_1 was phenotypically $Y_a\ R_2^{AS}$ (yellow corolla/Sun-red, spotted) and the combined segregation in back crosses and F_2 summarised in table 4(b) would show that there is independent assortment of the corolla colour and anthocyanin genes.

Cross 3: CST. 3 x N. R. 5 Yellow corolla/Green stem-Ghost x White corolla/pigmented red spot.

TABLE IV (a)

Cross 2: CST. 3 x Cernuum: Yellow corolla/Green stem Ghost x Pale-yellow corolla/Pigmented–Red spot

Generation	No. of plants				Total	X^2	P. value between
	Yellow Red spot	Pale-Yellow Red spot	Yellow Ghost	Pale-yellow Ghost			
F_1	32	..	..	..	32	..	..
Back cross with CST. 3	58	..	52	..	110	0·328	0·50 — 0·70
Back cross with Cernuum	56	42	..	..	98	2·000	0·10 — 0·20
F_2 Total of 4 families	227	72	77	22	398	0·543	0·90 — 0·95

TABLE IV (b)

Cross 3: CST 3 x N. R. 5: Yellow corolla/Green stem–Ghost x White corolla/Pigmented Red spot

Generation	No. of plants				Total	X^2	P. value between
	Yellow Red spot	White Red spot	Yellow Ghost	White Ghost			
F_1	37	..	..	..	37	..	..
Back cross with CST. 3	35	..	34	..	69	0·014	0·80 — 0·99
Back cross with N. R. 5	16	10	..	..	26	1·384	0·20 — 0·30
F_2 Total of 7 families	148	51	57	16	272	0·928	0·80 — 0·90

Cross 4: CST. 3 Sanguineum 119 (*indicum* x *bengalense*) Yellow corolla/Green stem – Ghost x Red on Yellow/Full red-spotted.

This cross represents $Y_a\ Y_a\ R_2^{os}\ R_2^{os}$ x $Y_a\ Y_a\ R_2^{RS}\ R_2^{RS}$.

The parents differ only in their anthocyanin genotype and the segregation for this character has been presented earlier. In respect of corolla colour, both the parents carry the Yellow corolla gene Y_a, but the phenotypic expression of the same is greatly modified by the anthocyanin background and the grades of corolla colour in segregating populations vary in the heterozygous and homozygous phases of both the genes. These results are discussed in the subsequent section of this paper.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*) Yellow corolla/Green stem-Ghost x Red on White Full red-spotted.

This is a cross between $Y_a\ Y_a\ R_2^{os}\ R_2^{os}$ and $Y_a\ Y_a\ R_2^{RS}\ R_2^{os}$. The F1 was phenotypically Red on Yellow/Full red spotted ($Y_a\ Y_a\ R_2^{RS}\ R_2^{os}$) and in the F_2, independent dihybrid assortment was obtained in the ratio of 9 : 3 : 3 : 1 for the four phenotypes, Red on Yellow/Full red-spotted; Red on White/Full red-spotted; Yellow corolla/Green stem-Ghost and White corolla/Green stem-Ghost. The last-mentioned phenotype was confirmed to be so in further breeding tests, since Ghost spot will not be visible against White corolla background, but merely appear as spotless.

The combined assortment in F_2 and back crosses is summarised in table 4(c).

The corolla colour grading in respect of the Y_a gene in its homozygous and heterozygous phases in the R_2^{RS} background is discussed in the next section.

(iv) *Interaction of genotypes:* The inheritance of anthocyanin and corolla colour in the crosses involving the two Sanguineum parents which carry the highest member of the anthocyanin allelomorph series viz. R_2^{RS} presents interesting data for study of the interaction of genotypes and the same is dealt with in this section. The phenotypic expression of the corolla colour genes $Y_a\ Y_a$ (Yellow) and $Y_a\ Y_a$ (White) in their homozygous and heterozygous states is modified by the anthocyanin genotype.

TABLE IV (c)

Cross 5: CST. 3 x Sanguineum Major: Yellow corolla/Green stem–Ghost x Red on White/Deep Red-spotted

Generation	No. of plants				Total	X^2	P. value between
	Red on Yellow spot	Red on White spot	Yellow Ghost	White Ghost			
F_1	8	..	..	..	8	..	..
Back cross with CST. 3	79	..	97	..	176	1·840	0·10 — 0·20
Back cross with Sanguineum major	31	21	..	..	52	1·924	0·10 — 0·20
F_2 Total of 3 families	176	56	68	12	312	4·536	0·20 — 0·30

All *arboreums* homozygous for both R_2^{RS} and Y_a grade consistently at 10-11 (Silow and Yu 1942) and this is found to be the feature in the case of the Sanguineum 119 parent utilised in the present study. This phenotype may be designated as 'Red on Yellow' corolla.

The CST. 3 x Sanguineum 119 F_1 heterozygous for both R_2^{RS} and Y_a graded at 7-8 and in the F_2, segregation was obtained in the ratio of 1:2:1 for parental: F1 grades of 'Red on Yellow'; Yellow corolla respectively.

In the backcross with R_2^{OS}, all the R_2^{RS} R_2^{OS} segregants graded at 7-8 as expected, while in the backcross with R_2^{RS}, a 1:1 segregation was obtained far parental and F_1 grades of 'Red on Yellow' corolla, which gave a good fit to the genotypic expectations. The relevant data are furnished in table 5.

Cross 4: CST. 3 x Sanguineum 119 (*indicum* x *bengalense*)
$R_2^{OS} R_2^{OS} Y_a Y_a$ x $R_2^{RS} R_2^{RS} Y_a Y_a$

The sanguineum 119 parent is homozygous for both R_2^{RS} and Y_a; the F_1 is heterozygous for R_2^{RS}; in the back cross with CST. 3 ($R_2^{OS} R_2^{OS} Y_a Y_a$), the phenotypically R_2^{RS} segregants are all heterozygous for this gene (i. e.) like the F_1; in the back cross with Sanguineum 119 ($R_2^{RS} R_2^{RS} Y_a Y_a$), the phenotypically R_2^{RS} segregants are in the homozygous and heterozygous phases in the proportion of 1:1; in the F_2, the R_2^{RS} segregants occur in the ratio of 2:1 in the heterozygous and homozygous phases respectively.

The data on petal pattern grades furnished in the table above accord well with these expectations.

The Sanguineum major parent carries the R_2^{RS} and Y_a alleles in their homozygous phase and the phenotypic expression of corolla colour in this parent may be designated as 'Red on White'. This parent graded at 1 and the F_1 CST. 3 x Sanguineum major which has a genetic constitution of $R_2^{RS} R_2^{OS} Y_a Y_a$ was found to posses grade 7 corolla colour.

The data pertaining to this cross are as follows.

Cross 5: CST. 3 x Sanguineum major (*indicum* x *bengalense*)
$R_2^{OS} R_2^{OS} Y_a Y_a$ x $R_2^{RS} R_2^{RS} y_a y_a$

The frequency arrays of petal pattern distribution of the R_2^{RS} components in the different generations, as graded with Hutchinson's petal colour grades are furnished in table 6.

TABLE V

Frequency array of petal pattern distribution

S. No.	Material	Hutchinson's R_2^{RS} grades 7 8	9	10	Total plants	X^2	Value of P. between
1.	Sanguineum 119	..	..	13	13	..	..
2.	CST. 3 x Sanguineum 119 F_1	20	..	..	20	..	..
3.	Back Cross with CST. 3	116	..	..	116	..	..
4.	Back cross with Sanguineum 119	34	..	25	59	1·370	0·2 — 0·3
5.	F_2 Total of 3 families	131	..	77	208	1·273	0·2 — 0·3

TABLE VI

Frequency arrays of petal pattern distribution

S. No.	Material	Hutchinson's R_3^{RS} grades 7	8	9	10	11	Total plants	X^2	Value of P. between
1.	CST. 3 x Sanguineum major F_1	8	..	..	..	8	..	...	..
2.	Back cross with CST. 3	20	47	14	..	81	..	..	..
3.	Back cross with Sang. major	10	10	1	4	..	25	..	---
4.	F_2 Total of 3 families	34	57	10	31	1	133	0·184	0·5 — 0·7

Only the R_2^{RS} segregants are dealt with, since only in this genotypic background, the expression of the Y_a gene is modified.

The F_1 which is heterozygous for both R_2^{RS} and R_2^{OS} graded at 7. The genotypes in the backcross with CST. 3 are 1) $R_2^{RS}\ R_2^{OS}\ Y_a\ Y_a$ and 2) $R_2^{RS}\ R_2^{OS}\ Y_a\ y_a$ and this population has graded 7 to 9 with no indication of any segregation. In the back cross with Sanguineum major, the genotypes are $R_2^{RS}\ R_2^{RS}\ Y_a\ Y_a$ and $R_2^{RS}\ R_2^{RS}\ y_a\ y_a$.

A large enough population in this back cross would possibly yield a 1 : 1 segregation for grades 7 and 8 : grades 9, 10 and 11.

In the F_2, the genotypes of the phenotype 'Red on Yellow' i. e. R_2^{RS} component are:

	Frequency	
(1) homozygous for R_2^{RS} and homozygous for Y_a	1	3
(2) homozygous for R_2^{RS} and heterozygous for Y_a	2	
(3) heterozygous for R_2^{RS} and homozygous for Y_a	2	6
(4) heterozygous for both R_2^{RS} and Y_a	4	

Items 1 and 2 may be expected to grade 9-11, while items 3 and 4 will cover grades 7 and 8.

From the frequency distribution of this phenotype in the F_2 population, a close fit to 1 : 2 segregation is obtained in respect of the above classes.

The interaction of the R_2^{RS} allele with the corolla colour genotypes may be summed up as follows:

(1) Homozygous R_2^{RS} with homozygous Y_a grades 10 and above.

(2) Homozygous R_2^{RS} with heterozygous Y_a grades not below 9.

(3) Heterozgous R_2^{RS} with homozygous or heterozygous Y_a grades 7 and 8.

(4) The influence of heterozygous Y_a on the expression of R_2^{RS} in corolla colour, is only slight and does not shift the grade below one, to that obtained in the homozygous phase.

Summary: The inheritance of the Cocanadas Green stem/Ghost spot type, spotted in Peninsular Indian *G. arboreum* race *indicum*, in five inter-racial crosses with Sun-red/spotted and Full red/Spotted; yellow corolla, Pale yellow and White corolla genotypes is reported.

In anthocyanin inheritance, the Green stem/Ghost which carries the R_2^{OS} allele confirmed its behaviour as a simple recessive to the R_2^{AS} (Sun-red/Spotted) and R_2^{RS} (Full red/spotted) alleles of the anthocyanin multiple allelomorph series.

In respect of corolla colour, the Pale Yellow corolla (Y_a^P) of *Cernuum* and White corolla (y_a) of N. R. 5 behaved as simple recessive to Yellow corolla (Y_a) of the Green stem/Ghost parent. In the cross with Sanguineum 119 carrying Yellow corolla gene Y_a, phenotypic segregation for corolla colour was however obtained due to differences in their anthocyanin genotypes and the same was identical with that of anthocyanin segregation. In the cross with Sanguineum major carrying the White corolla gene Y_a, four phenotypic classes were obtained in the F_2, due to the interaction of the R_2^{RS} anthocyanin allele on corolla colour expression and the segrega tion accorded well with the expectations.

Anthocyanin and corolla colour genes assorted independently in all the crosses studied.

The interaction of the R_2^{RS} anthocyanin genotype on the expression of corolla colour was studied with reference to colour plates of Hutchinson (1932) in the two crosses involving Y_a and y_a alleles and the results have been discussed.

It was shown that while heterozygosity of the R_2^{RS} allele brought down the grade of petal pattern, the influence of heterozygous Y_a on the expression of R_2^{RS} in corolla colour, was only slight and did not shift the grade below one, to that obtained in the homozygous phase.

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Science for the Farmer — II

Grass for Fertility

by

R. M. SAVUR, I. E. S. (Retd.)

During the last few years there has been in this country a spate of talk about scientific farming and carrying science to the farmer. The sum and substance of all this talk that is being made seems to me to be nothing but a lavish use of ammonium sulphate and insecticides. My ten years' study of agriculture has, however, given me a totally different idea of scientific farming. I am attempting to express here the essence of what I have learnt, in the hope that if I am wrong, some expert will put me right.

I have gathered that the type of soil fertility which results in high productivity depends firstly, upon a certain physical condition of the soil. The physical properties of the soil which determine productivity are known collectively as "soil structure" by which is ment the state of aggregation of the soil particles on which depend the principal air and water regimes of the soil. In a structureless soil the separate particles tend to pack into the smallest possible space, producing a minimum of porosity, aeration, permeability, and water-holding capacity, which are qualities indispensable to the healthy growth of cultivated crops. We are told that experience has shown that the degree of granulation of a soil is a rough measure of its state of fertility, and that the higher the state of granulation of any given soil the more productive it will be, as measured by crop yields.

Considerable research has been made on this so-called "granular structure", (commonly also spoken of as "crumb" structure) in which the granules or crumbs are formed when separate particles of sand, silt, clay etc. are cemented together by means of the organic and inorganic colloids in the soil. Innumerable experiments have been made to study the effect on crop yields of varying degrees of granulation in the same soil with other factors like manuring kept constant. I quote only one instance. Striking results were observed in an investigation of the relation of onion yields to degree of soil granulation. The yields of onions increased from 157 bushels per acre to 487 bushels, more than threefold, as soil in granules larger than 0·5 m.m. increased from about 21 to 37 percent. This high yield was obtained in a rotation in which the onion crop followed two years of grass. In an earlier experiment

on similar soil the onion yield increased from 72 bushels to 524 bushel with an increase in granulation from 21 to 37·9 per cent. Another effect of improved soil structure of immense importance to us is that a granular soil offers considerable resistance to erosion even when bare of vegetation.

Humid climates exert a disintegrating effect on soil structure and granulation is less highly developed than in more arid climates and destruction of soil structure is very rapid under heavy rainfall. Both these factors, inimical to the formation and maintenance of soil structure are present on our West Coast. Add to this the fact that red laterite soil is the least fertile type of soil even to begin with and we can appreciate the importance to the West Coast farmer of systems which will develop and maintain a high degree of granulation.

What I read about soil structure so impressed me that I felt forced to take stock of my own farming. Logical thinking is indispensable to scientific method. I found myself facing two facts :—

1. The extremely low fertility of my sandy soil which was in most parts of the farm below even what may be called the threshold level, below which even weeds do not grow.

2. It is notoriously difficult to bring pure sand without even a trace of silt or clay into a state of aggregation of the sand grains. If, I said to myself, I am to make my farming venture pay, I must first restore "structure" to my structureless soil. What is the most efficient and most economical method of bringing about aggregation into granules? The advice most commonly thrust on one is to add silt or clay. This is from my experience, the most expensive and at the same time the most inefficient method, It means merely heavy capital expenditure which will not yield an adequate return even in the first year of application; and in this deep sand no trace of the silt or clay will be visible after a couple of years of cultivation. In any case even this ephemeral effect of added silt will be only on the top three or four inch layer of sand. The temporary beneficial effect on crop yields produced by heavy additions of silt or clay to sands is due more to the manurial content of the additions than to physical qualities; for silts and clays can be devoid of structure, and structureless silts and clays are worse than sands from the point of view of plant growth, which depends on root penetration and spread.

We must first learn how these aggregates, granules, or crumbs are formed out of discrete particles of soil, for every type of soil-silts, clays or loam – will be structureless unless the necessary causal factors are present in the soil.

The two causal factors are — (I) root action

— (2) the cementing substances which are formed when organic matter is reduced to humus by the action of soil bacteria and fungi.

Though both are necessary for aggregate formation, root-systems play an active part and are therefore the more important; for investigations have shown that farmyard manure, composts or green manure, fail to have the desired effect on soil structure. The root systems of plants by themselves will have the desired effect upon the soil because they are also the source of much humus to cement the soil particles into aggregates. Organic manures accelerate the processes by serving as a source of ample food for bacteria and consequent rapid conversion to humus. The addition of farmyard manure and ripe compost will also provide ample supplies of microbes to soils like sands with low microbial populations. If that is all there is to restoring soil structure, are we not growing crops which have root systems and manuring them, even if inadequately, with organic manures? Why then should any special measures be necessary to form soil aggregates? Unfortunately, it seems that (to make the farmers task more difficult) Nature has decreed that granulation can be effected only by a special type of root system which is denied to our normal cultivated crops. One can understand the uselessness of the paddy crop as a builder of soil structure, for in many respects it is an abnormal crop revelling in puddled, swampy conditions which destroy all structure, but even the dryland, cereal crops like sorghum apparently have not the type of roots which can form aggregates. Moreover, to get good yields from our crops we have to do so many cultivations, hoeings, weedings, and irrigations; all operations which tend to destroy structure, that after a few successive cultivated crops, there is very little left of the aggregates that might have existed at the start.

The most efficient natural producer of granular soil structure is grass and this is one more reason why livestock are said to be inseparable from good farming. Soil granulation in all climates, we are assured, becomes greater under perennial grasses than under any other kind of vegetation. Several explanations of the action of a

grass crop in granulating the soil have been given, but, for us farmers, the essential fact is that under all circumstances it does have this granulating effect which, from the point of view of maintaining on increasing soil fertility, is one important reason for introducing perennial grasses in the crop rotation. Some other observations derived from scientific research which are of practical importance to farmers are:—

(1) Even grasses vary considerably in their granulating ability because of differences in their root-system and habits of growth. For instance, among tropical grasses, which alone are of any use to us in this part of our country, the most outstanding in graulating ability is said to be elephant grass, whereas a stoloniferous grass with stolons buried deep in the soil like *Panicum repens* is practically useless. *Panicum repens*, in spite of its palatability, drought resistance, and its ability to survive and grow in the most unpromising soil, is an obnoxious pest on arable land.

(2) The most active part of a grass crop in aggregate formation is the root system which is not only the source of much of the humus, which cements the soil particles in aggregates but also has a purely mechanical action which assists the formation of aggregates of the right size while preventing the soil from coalescing into clods.

(3) In the tropics, Uganda was the first colonial territory to adopt the grass-resting period for the restoration of soil structure as the corner-stone of its agricultural policy. The Uganda investigations have shown (a) farmyard manures and composts fail to have the desired effect on soil structure. (b) the root systems of legumes are not so valuable in crumb formation as are those of grasses.

(4) Legumes add fertility by the nitrogen-fixing activities of nodule bacteria but their root systems produce only a cloddy structure throughout the root-inhabiting layer which, though it assists aeration and peremeability, particularly in the deeper layers, has not the effect on the following cereal crops in the rotation, which the well-developed medium to fine structure in the top 18 inches to 2 feet of soil produced by grasses has on increasing yields of crops which follow grass in the rotation.

(5) The optimal air-water regimes throughout the entire soil to a depth of several feet is therefore effected by a mixture of legumes and grass. Numerous investigations have indicated the superiority, from the structure point of view, of a mixture of grasses and legumes over either component separately.

For this as well as other reasons, in all those countries which grow grass as a crop for fertility restoration and livestock maintenance "grass" has come to mean the sward produced by sowing a seeds mixture of grasses, legumes, and possibly other plants.

In Europe, grass is an essential crop invariably grown in the rotation though farmyard manure is so plentiful that the minimum basic dose used is 10 to 15 tons an acre. Though we have in this country hundreds of millions of cattle, farmyard manure is conspicuous by its absence on the average farm and yet nobody ever thinks of growing grass for restoring fertility or even just for feeding our animals.

Only one who keeps all these facts in mind will realise the full import of what one expert said:—

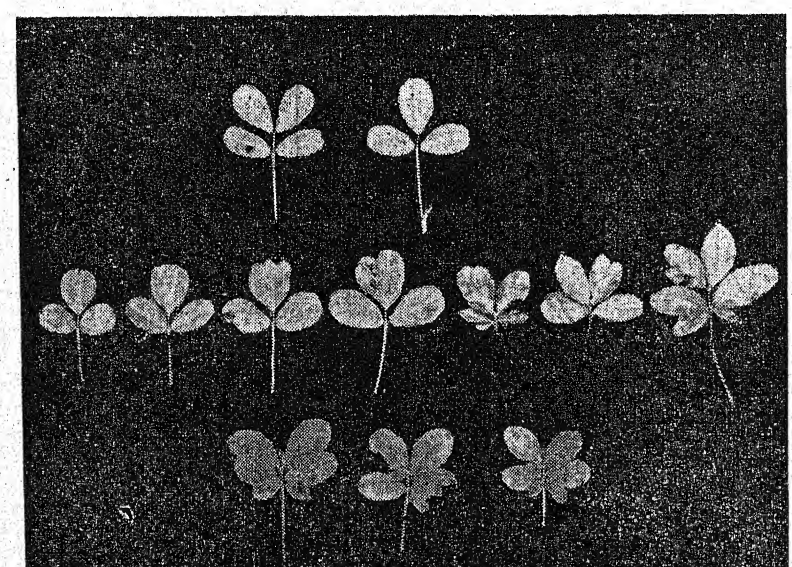
"Grass is the most important natural product that the country can possess. Grass restores natural fertility to the soil more quickly and more effectively than any other form of vegetation. Grass maintains the fertility of the soil longer than any other crop. Grass creates structure in soil more effectively than any other plant growth, and thereby renders it less liable to erosion than is the case under any other form of plant cover. The neglect of grass cover spells declining soil fertility and a crumbling agriculture; then poverty, ill-health, disease, hunger, starvation and national disaster follow".

We have always neglected grass and ruined our communal grazing grounds. Soil fertility has already declined and erosion has begun to be a serious problem. Our agriculture has been crumbling and we have poverty, ill-health, disease, hunger and starvation. Remains only national disaster to follow. Our community projects and our expanding extension services can save us from the inevitable national disaster only if they show a proper appreciation of the value of grass and the animal factor in the restoration of lost fertility and prevention of erosion.

The need is for a re-orientation of food and fodder production policies and the re-arrangement of ideas about farming generally.

Variations in the Leaflets of Groundnut, *Arachis, hypogea*, Linn.

The leaves of groundnut, *Arachis hypogea*, Linn, are paripinnately compound with four leaflets. Occasionally supernumerary leaflets are produced. Leaflets numbering five have been reported by Hayes [1] (1933). Abnormal leaves with five to seven leaflets have been recorded by Bhavani Shanker Rao and Srinivasalu [8] (1953). During the course of detailed study of individual plants in 1954 and 1955 rainfed seasons, leaves with only three pinnæ were noticed. At a particular period of growth – invariably in the initial stages of crop growth – the occurrence of trifoliate leaves was more than occasional and they were found irrespective of the varieties. The size of the terminal pinna was slightly bigger than the other two leaflets. All such trifoliate leaves were carefully examined and it was found that in rare cases, the midrib of the terminal leaflet got forked, causing varying stages of leaf division. The abnormalities noted are shown in the plate below :—



Legend

Top row :	Normal leaf with four pinnæ and trifoliate leaf.
Middle row :	Various stages of forking of the mid-rib in the abnormal trifoliate leaves and normal leaves.
Bottom row :	Leaf with seven to nine leaflets.

Discussion: The phenomenon of forking has been recorded by many workers in different plants. Forking of the mid-rib in the leaves

has been reported by Singh[10] (1930) in *Mirabilis jalapa*, by Sabnis[8] in *Anacardium occidentale*, by Singh[11] (1931) in *Ficus religiosa*, by Saran[9] (1934) in *Aralia guilfuylei* by Singh[12] (1935) in *Eranthemum atropurpureum*, by Narayan Rao[6] (1937) in *Tabernœmontana coronaria*, by Sundararaj et al[14] (1953) in *Azadirachta indica* and other plants and by a number of other workers. Similar forking of leaflets is now recorded in case of *Arachis hypogea*.

In the abnormal trifoliate leaves of *Arachis hypogea*, varying stages of forking and lobulation are met with. According to Celakovsky (quoted in Worsdell)[15], in the plant *Phaseolus multiflorus*, the terminal leaflet had by forking added a fourth leaflet to the usual three. The leaf of various species of Clover *(Trifolium)* produces frequently four leaflets and rarely more also, instead of the normal three. Sinha[13] (1932) has traced the stages of lobulation in *Ipomea pulchella* (the railway creeper) by forking of mid-rib. Kalyanasundaram[4] (1953) has stated that the imparipinnate leaf of the plant. *Clitoria ternatea* has been derived from simple and orbicular leaves which are found in the seedling stages and has recorded intervening stages of bilobation. The same author[5] (1954) after a study of seedlings of various species under Leguminosæ, with particular reference to ontogeny of leaves, has stated that the compound leaf is a derivative from more simpler ancestral forms. Thus it appears that the trifoliate leaf noticed in the groundnut mey be a case of reversion. It is of interest to note, that according to Hœhne (1943) (quoted in the book 'Peanut'[7]) atleast one species or perhaps two of the genus *Arachis*, possess normally trifoliate leaves. Chevalier[8] (1933) has described eleven species of *Arachis* and among them *Arachis guarantica* (found in parts of Paraguay) has a trifoliate leaf.

The occurrence of the trifoliate leaves was noticed only in the early stage, i.e., within a month after sowing and not in the adult plants. Such abnormal leaves are more common in the bunch types than in the spreading types. It was thought that the droughty conditions which prevailed at the time when the abnormal leaves were produced, were responsible for their production. But similar conditions prevailing in the later stages have not induced production of such abnormal leaves.

The production of such trifoliate and abnormal leaves with supernumerary leaflets was not found to be a heritable character. Further studies on the causes for the production of such leaflets are in progress.

Acknowledgement: We are thankful to Dr. T. C. N. Singh, M. Sc., D. Sc., F. B. S., Professor of Botany, Annamalai University, for his kind suggestions in writing this note.

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Sesbania aegyptiaca, Poir — A Perennial Greenleaf Manure Plant

Sesbania aegyptiaca Poir, is a native of tropical Africa, Asia and North Australia. It is cultivated throughout the tropics and found wild in tropical Africa. It is found throughout India from the Himalayas at an altitude of 4000 feet in the North-West to Ceylon and Siam. In Madras it is found both wild and cultivated in almost all the plain districts. Brandis (1907) mentions that on the banks of the Kistna and Warma rivers in the Deccan, which are submerged during the annual floods, it is grown from seed as an annual, attaining 15 to 20 feet in height.

Description: It is an unarmed, soft-wooded perennial shrub of short duration growing to a height of 6 to 10 feet, with terete, twiggy branches. Leaves 3 to 6 inches long with 10 to 20 pairs of glabrous, linear-oblong, pale-green leaflets. Flowers borne in lax, axillary racemes; calyx glabrous, membranous, with short teeth; corolla pale yellow, the standard usually purple or purple-spotted. Pod 6 to 9 inches long, slender, torulose with slightly thickened sutures.

Varieties: (Cooke 1909) in the Flora of Bombay Presidency describes two varieties. i. e.

Var *picta*, Prain — Standard mottled with purple on the outside and

Var *bicolor*, W & A — Standard maroon-coloured or dark purple (not mottled outside and the keel tipped with red.

According to Prain the typical *S. aegyptiaca* has uniformly yellow flowers and is a native of India. Both the above-named varieties are reported to be cultivated and more or less naturalised in Bombay.

Popular and local names: Its common English name is 'Common Sesban'. In Tamil it is known as *Chembai* or *Chitagathi*; in Malayalam as *Chemba* or *Kitaannu* or *Nellittali.*

Uses: It is used as a hedge plant and windbreak; also used as a shade tree and standard in betelvine gardens. The wood makes good charcoal for gunpowder.

Sampson (1936) and Watts (*1893*) mention that it is made into children's toys in Burma. In Assam the soft pithy stems of young plants are plaited into mats. It is said to be in common use in Bengal as a hedge plant. The bark yields a fibre which is made into ropes while the leaves and young branches are lopped off for fodder. A number of medicinal uses have been attributed to the leaves, bark and roots of this leguminous plant (Kirthikar and Basu: 1933)

Green Manure: It is not generally sown as a pure green manure crop in the fields, for ploughing *in situ.* The loppings can be used as

green manure, the plants being raised along the banks of rivers or tanks or even on field bunds and other suitable places. The plant stands lopping well and produces regrowths very quickly. The yield of green leaf is also very appreciable. As an observational trial, the seedlings of *Sesbania aegyptiaca* and *S. speciosa* of the same age, were planted side by side in the Botanical Garden, Coimbatore by the side of an irrigation channel on 4th February 1954. *Sesbania speciosa* plants dried up after 10 months and its regeneration capacity is also seen to be poor, compared to the other species. Regular loppings were taken from both the species and the data are given below.

Seedlings planted on 4th February 1954.

Date and No. of lopping		*S. aegyptiaca*					*S. speciosa*				
		No. of plants	Green leaf obtained		Average per plant		No. of plants	Leaf obtained		Average per plant	
			lb.	oz.	lb.	oz.		lb.	oz.	lb.	oz.
I	8—7—1954	7	2	12	0	6·3	5	6	4	1	4
II	30—8—1954	7	3	6½	0	7·8	8	14	4	1	12
III	6-11—1954	7	13	6	1	15	7	9	0	1	4
IV	24—1—1955	7	13	12	1	15½	Dried up on 20—12—1954				
		Continued to grow luxuriantly.									

Well-grown plants yield fairly good quantities of green leaves. Thus *Sesbania aegyptiaca* is a perennial, green-leaf-yielding plant with capacity to regenerate quickly after being pruned. These can be planted in field bunds and other suitable places so that they may serve as a perennial source of green leaf for manurial purposes.

25—11—1955,
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Abstracts

Potash Fertilizers: Potassium fertilizers are generally known as "Potash fertilizers" because in the fertilizer world they become associated with the potassium oxide compound called potash (K_2O) which is the conventional unit used in the Fertilizer and Feeding stuff Act for stating the amount of potassium in fertilizers. There are four principal potash fertilizers on the British Market. They are muriate of potash (K_2O-60% K_2O). Muriate of potash (50% K_2O) potash salt (40% K_2O) and sulphate of potash (48% K_2O). The lower grade salt, kainit is still used, but only to a small extent.

The present trend in the use of potash fertilizer in recent years has been the increasing preference for the concentrated type of salt—muriate of potash (60% K_2O). This helps to effect a saving in freight and handling charges. Another reason for this trend is that the highest grade is necessary for the manufacture of modern and more concentrated types of compound fertilizers which may contain up to 15% or even 20% potash (K_2O).

Question of Purity: The so-called impurities in the less concentrated forms contain something of value. The main impurities in potash salt (K_2O 40%) are rock or common salt (Sodium chloride) and magnesium salts. The rock salt has a recognised value for sugar beet, fodder beet, and mangolds, while magnesium salts are useful for horticultural crops like apples, gooseberries glass-house tomatoes etc. But these high-grade salts can however be used if the other salts present as impurities can be applied as special dressings without much upsetting the economy. So far as magnesium is concerned there is another potash fertilizer called sulphate of potash-magnesia or "Patent-Kali". It contains approximately 26-30% K_2O in the form of sulphate of potash and 25-35% sulphate of magnesium. The unit of potash in this fertilizer is dearer than in the normal potash fertilizers. It has also been argued that by the use of concentrated types of potash fertilizer certain trace or minor elements may be lost to the soil. Analyses have shown however, that such trace elements as boron, manganese, copper, zinc and molybdenum, even in the lower grade of potash fertilizers are present only in negligible amounts from less than 1 part per million to no more than 5 p. p. m. These quantities are valueless in view of the relatively small dressings used per acre of the potash fertilizers.

Muriate or Sulphate: So far as agricultural crops are concerned, no practical discrimination can be made between these fertilizers. In the case of potatoes, sulphate yields more starch and less water than muriate. The level of starch may be 1½ to 2% higher from sulphate. The difference is important where potatoes are grown for farina or alcohol but not in the case of edible purposes where no monetary credit is given for higher nutritive value. Where high dressings of potash are used, as in market gardening, the potash might be safely given as sulphate or as a mixture of sulphate and mutriate. Similar preference should be given to sulphate of potash for tomato crops when grown intensively under glass.

Leaching: The potash in the conventional potash fertilizers is soluble in water, but when applied to the soil it is immediately absorbed into the colloidal particles of the soil when it is no longer water-soluble. However it is liberated slowly by the process of base exchange to become available to the crops.

Colour: The colour of the potash fertilizer should not be taken as an index to their potassium content. Minute quantities of iron oxide, clay or organic matter tend to give a yellowish or brownish colour to the finished product.

Even in the high grade muriate of potash, the one manufactured by ordinary solubility method has a more or less white appearance, while the same salt made by another process (flotation process) has a reddish colour.

(Abstract from "Potash fertilizers"
by Cowie, G. A. Agriculture, Vol. LXII, 236, 1955)
(A. M. K. and S. V.)

Gleanings

Green Manuring with Maize Better Tobacco Crop: Cigarette Tobacco can be green-manured with maize. This practice adds humus to the soil, without adding too much nitrogen. Maize should be sown in the beginning of the monsoon, using 16 to 20 pounds of seed per acre. The green crop should be applied whole or cut up and placed in furrows between the second week of August and the first week of September. Maize will decompose and get thoroughly mixed up with the soil by the end of October or beginning of November, when tobacco is transplanted. In trials, cigarette tobacco crop green-manured with maize produced fifty per cent as bright grades when the unmanured plots produced very dark green leaf, giving only 10 per cent as yellow leaf. [I. C. A. R.]

Seed Coconuts Best Stored in Sand: Seed coconuts are best stored in fine sand instead of being kept exposed to the atmosphere. Arrange the seed nuts with the stalk-ends up on the floor of a shed over a layer of about three inches of sand. Cover the nuts with sand and keep them in this position till required for planting. When a large number of seed nuts have to be stored, add more layers of sand and seed nuts over the first layer. When nuts are being taken out for planting, reject those which do not contain water or those that rattle on shaking. [I. C. A. R.]

A New Bhindi Variety — Good Quality Fruits: A variety of *Bhindi* (Lady's finger) that gives an acre yield of 200 to 250 maunds of fruits has been evolved at the Indian Agricultural Research Institute, New Delhi. The variety is called *Pusa Mukhmali*. The fruits are six to eight inches long, straight, smooth and of an attractive green colour. The variety can be grown both as a summer crop as well as a rainy season crop. When sown for the summer crop, it fruits in about 50 days, while as a monsoon crop is takes ten more days to be available for harvest. In parts of Northern India which have a fairly cool winter, *Pusa Mukhmali* can be sown towards the end of February. The sowings can be continued till the middle of July. For the main summer crop, sowing should be completed by March. For the rainy season crop, it is better to sow it well in advance of the break of monsoon, and complete sowing by about the middle of June or even earlier. In the warmer southern and western parts of the country, the main sowings should be done, similarly excepting that sowings can begin earlier in January. [I. C. A. R.]

Weather Review — For December, 1955

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	5·1	— 0·4	52·0	South	Madurai	8·7	+ 6·7	45·3
	Tirurkuppam*	5·2	— 0·3	50·5		Pamban	17·7	+ 9·8	45·6
	Vellore	4·1	+ 1·5	37·1		Koilpatti*	6·5	+ 4·8	27·0
	Gudiyatham*	2·6	— 0·1	35·5		Palayamcottai	2·1	— 2·1	28·8
						Ambasamudram*	3·2	— 2·0	35·5
East Coast	Palur*	9·3	+ 2·5	54·5	West Coast	Trivandrum	4·5	+ 2·0	82·4
	Tindivanam*	4·7	+ 0 8	41·7		Fort Cochin	0·4	— 1·2	147·7
	Cuddalore	10·0	+ 2·5	52·7		Pattambi*	0·4	— 0·9	100·1
	Nagapattinam	9·4	— 1·6	54·2		Kozhikode	Nil	— 1·5	153·9
	Aduthurai*	11·3	+ 7·0	50·6		Taliparamba*	Nil	— 1·4	137·5
	Pattukottai*	15·9	+11·7	48·9		Wynaad*	0·4	— 0·5	77·6
						Nileshwar*	Nil	— 1·0	177·5
						Pilicode*	Nil	— 1·0	151·4
Central	Salem	1·7	+ 0·7	37·4		Mangalore	Nil	— 0·7	150·3
	Coimbatore (A. M. O.)*	1·0	— 0·2	18·1		Kankanady*	Nil	— 0·5	151·3
	Coimbatore	1·2	+ 0·1	19·6	Hills	Kodaikanal	10·4	+ 5·2	83·9
	Tiruchirapalli	8·5	+ 5·9	47·0		Coonoor*	6·8	+ 0·3	53·0
						Ootacamund*	2·7	+ 0·4	67·9
						Nanjanad*	1·2	— 0·5	60·4

Note :— * Meteorological Stations of the Madras Agric. Dept.

A deep depression in the South-West Bay intensified into a cyclonic storm by the evening of 30—11—1955. Moving in a westerly direction it crossed the coast on 1—12—'55 (morning) to the south of Nagapattinam and weakened into a depression about 50 miles of Tiruchirapalli. Under its influence widespread and locally heavy rain occurred in Tamilnad. It became weak the next day and moved as a low pressure wave into the South-East Arabian Sea across Travancore-Cochin on 2—12—'55. The weather was markedly unsettled in the South-East Arabian Sea, off the Malabar Coast. The effect of this depression resulted in fairly widespread rain in Tamilnad and Travancore-Cochin in the first four days of the month. In the subsequent five days localised showers were received in Tamilnad. Then on 10—12—1955 the weather became dry with a fall in night temperature and this sort of weather continued upto 19—12—1955 with no large change. On 20—12—1955 a feeble incursion of moisture took place over Tamilnad and it continued on the next day also. Anyway this incursion of moisture did not alter the weather, which remained practically dry throughout the remaining portion of the month. Only slight fluctuations in the night temperature were observed.

In the latter half of the month a number of Western disturbances were noticed with no appreciable change in weather conditions.

The districts of Madurai, Tiruchirapalli, Tanjore and Ramanathapuram were affected by the cyclone, which gained velocity after sunset on 30—11—1955. The worst affected areas were in Tanjore and Ramanapuram districts. To add to the cyclone ravages a tidal wave upto a height of 6 feet inundated Point Calimere, Agastiampalli, Vedaranyam, Thopputhurai and other places. Considerable damage was done to men and cattle, besides the widespread loss to crops, cultivated as well as perennial.

In the first four days of the month heavy rains were received in the following places as indicated hereunder:

Nagapattinam 8·5″
Tiruchirapalli 6·0″
Cuddalore 8·5″
Tuticorin 11 5″
Madurai 8·0″

The noteworthy rainfalls and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
1/12/55	Nagapattinam	5·4	North	4·3	+ 0·2	Just above normal
,,	Tiruchirapalli	3·3	East Coast	10·1	+ 3·8	Above normal
2/12/55	Madurai	6·5	Central	3·1	+ 1·6	do.
,,	Kodaikanal	2·0	South	7·6	+ 3·4	do.
,,	Cuddalore	3·7	West Coast	0·6	— 0·7	Far below normal
,,	Kallakurichi	2·8				
3/12/55	Tuticorin	7·4	Hills	5·3	+ 1·8	Above normal

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 7—1—1955.

C. B. M. & M. V. J.

Departmental Notifications

Gezetted Service — Postings and Transfers

Name and present post	Posted as
Anantaraman, S. E., Assistant Agricultural Engineer, River Pumping Scheme, Madras,	Assistant Agricultural Engineer, Office of the D. A., Madras
Kanakaraj David, S., P. P. O., Entomology, Coimbatore,	Lecturer in Entomology, Coimbatore
Kannian, K., Additional Superintendent, Central Farm, Coimbatore,	Assistant Cotton Specialist, Koilpatti
Muthuswami Iyer, S., Special D. A. O., Kozhikode,	Additional D. A. O., Tanjore
Leo Swamikkan, Assistant Agricultural Engineer, Ooty,	Assistant Agricultural Engineer, Coimbatore
Mohamad Ali, Assistant Agricultural Engineer, Madras,	Assistant Agricultural Engineer, Ootacamund
Nagaraja Rao, K. R., Assistant in Entomology, Coimbatore,	P. P. O., Entomology, Coimbatore

Name and present post	Posted as
Raman Menon, K., D. A. O., on leave,	Special D. A. O., Crop Sampling, Kozhikode
Subramaniam, A., Assistant in Millets, Coimbatore,	Assistant Millets Specialist, Coimbatore
Sriraman, K., Assistant Marketing Officer, Coimbatore,	Additional D. A. O., Trichy
Subramaniam, C. R., Assistant Agricultural Engineer, on leave,	Assistant Agricultural Engineer, River Pumping Scheme, Madras
Varisai Muhamad, S., Assistant in Oil Seeds, Coimbatore,	Additional Superintendent, C. F., Coimbatore
Subramania Sarma, A. H., Lecturer in Agricultural, Coimbatore,	Special Assistant Marketing Officer, Livestock, Hosur
Sriraman, K., Additional D. A. O., Trichy,	Special Assistant Marketing Officer, Livestock, Trichy

Upper Subordinates

Name and present post	Posted as
Annaswami, N., P. A. P., Pattukottai,	P. P. A., Salem
Balachandran, M., Cotton Assistant, Aduthurai	Cotton Assistant, Coimbatore
Balagopalan, A., A. D., Manjeri,	A. D., Kannamangalam
Chami, A., A. D., Pollachi,	A. D., Hanur, Coimbatore Dt.
Govinda Kurup, K., Additional D. A. O., Trichy,	A. D., Manjeri
Muthuswami, P. N., Agricultural Instructor, Coimbatore,	A. D., Pollachi
Narayanan, C. K., A. D., Peravurni,	Pepper Development Assistant, Taliparamba
Padmanabha Nambiar, K. P., Fruit Assistant, Taliparamba,	Pilot Pepper Survey Scheme, Taliparamba
Ramanathan, R., F. M., C. F., Coimbatore,	Horticultural Assistant, Coimbatore
Radhakrishnan, M., A. D., Keeranur,	Pepper Development Assistant, Rajapuram
Ranganadha Prabhu, K., Pepper Development Assistant, Rajapuram,	A. D., Vegetables, Madras
Shivarama Pai, P. C., Assistant, I/C., A. R. S., Nilsshwar,	Coconut Nursery Assistant, Nileshwar
Subramanlam, P. T., Pepper Development Assistant, Taliparamba,	Fruit Assistant, Taliparamba
Swaminathan, R., Millets Assistant, Coimbatore,	Millets Assistant, Koilpatty

Name and present post	Posted as
Sethuraman, M. S., P. P. A., Salem,	P. A. to D. A. O., Salem
Swamiappan, S., A. D., Kundadam,	A. D., Udamalpet
Srinivasalu, N., O. S., Assistant, Tindivanam,	O. S., Assistant, Coimbatore
Thomas, N. K., on leave,	P. A , to D. A. O., Tellichery
Varadarajan, K.,	Chemistry Assistant, Palur
Venkataramana Rao, V. G., A. D., Vegetables, Madras,	Marketing Assistant, Madras
Viswanathan, P. S., Cotton Assistant, Trichengode,	Chemistry Assistant, Coimbatore
Varadachari, T. E., A. D., Gingee,	Technical Assistant, under Regional (Food) Government of India
Ummerkutty, O. V., Coconut Nursery Assistant, Nileshwar,	Assistant, in-charge A, R. S., Nileshwar
Kulandaivelu Naicker, R., A. D., Kanchipuram,	A. D , Gingee
Ramachandra Rao, C., Kakinada,	Paddy Assistant, Palur
Venkatachayanulu, Innipeta,	Cotton Assistant, Koilpatty
Ramakottiah, P., Vijayawada,	Cotton Assistant, Trichengode
Mehaboob Sharif, Kandapalle,	Cotton Assistant, Palur
Prasad, D. V. V., Butlaipet,	Entomology Assistant, Coimbatore
Pai, R. A., Cochin,	Millet Assistant, Coimbatore
George David, Trivandrum,	Allotted to Malabar Dt.
Venkataswamy, B., A. D., Cuddalore,	P. A., to D. A. O., Vellore
Ananthachari, P. S., P. A., to D. A., Vellore,	P. P. A., (Myco.) Guindy
Bharathan, P., P. P. A., (Myco.) Guindy,	P. P. A., Cuddalore
Pinakapany, N., P. P. A., Cuddalore,	A. D., Cuddalore

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR, S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for December, 1955.

I. **Cotton:** (In this section: Candy = 784 lb; Pothi = 280 lb.)

1. *Cotton Stocks:* 1-1: *Tirupur:* 1-1-1: *Lint:* At Tirupur the cotton market opened with a stock of 4,416 candies of Cambodia and 2771 cdys. of Karunganni. During the month about 3,805 cdys. of Cambodia and 1,461 cdys. of Karunganni were estimated to be the arrivals. Despatches to other States and districts were to the tune of 4,927 cdys. of Cambodia and 2,878 cdys. of Karunganni. The chief movements were to Bombay, Orissa, Travancore-Cochin and to other districts in the State like Tirunelveli, Madurai, Salem, North Arcot and Madras. The closing balance during the month was 3,294 cdys. of Cambodia and 1,354 cdys. of Karunganni.

1-1-2: *Kapas:* The kapas market at Tirupur opened with a balance of 7,770 pothis of Cambodia and 1,003 pothis of Karunganni. Arrivals during the month amounted to 5,991, pothis of Cambodia and 178 pothis of Karunganni as against the arrivals of 11,965 pothis of Cambodia and 202 pothis of Karunganni during the previous month. Disposals in the month amounted to 8,642 pothis of Cambodia and 789 pothis of Karunganni. The market closed with a stock of 5,119 pothis of Combodia and 392 pothis of Karunganni at the end of the month.

1-2: *Koilpatti:* 1-2-1: *Lint:* During the month the market opened with a stock of 38·3 cdys. of Karunganni and 450 cdys. of Uganda. Arrivals during the month amounted to 600 cdys.

of Karunganni and 200 cdys. of Uganda as against the arrivals of 800 cdys. of Karunganni and 300 cdys. of Uganda during the previous moth. Disposals during the month amounted to 500 cdys. of Karunganni and 200 cdys. of Uganda. The month closed with a stock of 933 cdys. of Karunganni and Uganda.

1-2-2: *Kapas:* The kapas market was inactive with partically no transactions and the month closed with no stocks.

1-3: *Ramanathapuram District:* 1-3-1: *Lint:* The three markets of Virudhunagar, Sathur and Rajapalayam together, opened with a stock of 1,100 cdys. comprising of 140 cdys. of Karunganni, 920 cdys. of Uganda and 40 cdys. of Cambodia at the beginning of the month. Recipts in the month amounted to 1,125 cdys. which included 170 cdys. of Karunganni, 585 cdys. of Uganda and 370 cdys. of Cambodia as against the total arrivals of 2,075 cdys. during the previous month. Disposals during the month amounted to 1,210 cdys. comprising 290 cdys. of Karunganni, 510 of Uganda nnd 410 cdys. Cambodia. The month closed with 1,015 cdys. of all varieties.

1-3-2: *Kapas:* During the month the transactions were moderate. The actual arrivals, stocks and disposals of kapas in the markets of Sathur, Rajapalayam and Virudunagar for the month of December 1955 were as hereunder:

Opening stock	...	2,050 pothis
Arrivals during this month	...	1,850 ,,
Disposals	...	3,500 ,,
Closing stock at the end of the month	...	Nil

As the season for Karunganni and Ugonda cotton is coming to a close, the arrivals noticed were at lower levels than in the previous month.

1-4: *South Arcot District:* 1-4-1: *Kapas:* The markets of South Arcot District opened with a stock of 302 pothis of kapas at the beginning of the month. Arrivals in the month were 1,328 pothis as against 2,743 pothis during the last month. The arrivals were confined only to Villupuram and Panruti markets. Despatches in the month accounted for 1,504 pothis which were chiefly sent to Tirupur in Coimbatore district. There was a closing stock of 126 pothis at the end of the month.

2. *Cotton prices:* 2-1: Lint: 2-1-1: *Tirupur:* The cotton market was very firm during the month. The price of Cambodia lint was ranging between Rs. 850/- and Rs. 911/- according to quality. There was no transaction in Karunganni lint.

2-1-2: *Koilpatti:* Price of Karunganni lint opened at Rs. 720/- to Rs. 740 for the best quality and after a little advancement closed at the end of the month at Rs. 760/- to Rs. 780/- per candy. Prices of Karunganni II quality opened at Rs. 700/- and closed at Rs. 740/- at the end of the month. Transactions under Uganda cotton were negligible during the month. The market ruled steady and was placed at Rs. 1,100/- to Rs. 1,120/ for the certified quality and at Rs. 990/- to Rs. 1,000/- for the uncertified quality.

2-1-3: *Ramanathapuram District:* The opening nnd closing prices of lint as in the three markets are extracted below:

Variety of cotton		*Prices per candy* *Opening price*	*Closing price*
Karunganni I crop	...	716—756	766— 781
,, II ,,	...	599—656	630— 660
Tinny	...	No transactions	
Tinny Karunganni mixture	...	do	
Uganda M. U. II certified	...	—	1,176—1,180
,, M. U. I ,,	...	No transactions	
Uganda certified	...	940—960	996—1,000
Cambodia superior	...	750—800	750— 800
,, average	...	700—750	700— 750
,, inferior	...	600—700	600— 700

2-2: *Kapas:* 2-2-1: *Tirupur:* The prices of Karunganni and Cambodia kapas were transacted at Rs. 90–96/4 and Rs. 110–121 per pothi.

2-2-2: *Koilpatti:* There were no transactions of kapas during the month in this market.

2-2-3: *Ramanathapuram District:* The opening and closing price of kapas that prevailed in the three markets of this district are extracted below:

Varieties		(Prices per pothi) *Opening*	*Closing*
Karunganni I crop	...	92—109	93—100
,, II ,,	...	78— 85	75— 82
Uganda	...	131—138	131—138
Cambodia	...	52—118	75—100

2-2-4: *South Arcot District:* The average price of cotton kapas marketed in this district ranged from Rs. 80—6—0 to 83—4—0 per pothi.

2-3: *Cotton seeds:* 2-3-1: *Koilpatti:* The price of Karunganni and Uganda seeds continued to be firm, mainly due to low stocks. Karunganni seeds opened at Rs. 37—39 per pothi of 280 lb. and remained more or less at this level throughout the the month. Uganda seeds ruled firm at Rs. 35—37 per pothi.

2-3-2: *Ramanathapuram District:* The opening and closing prices of cotton seeds in all the markets of this district are extracted below:

(Prices per pothi)

Variety		*Opening*	*Closing*
Karunganni	...	Rs. 33—34	Rs. 34—34/8
Uganda	...	Rs. 30—33	Rs. 22—27
Cambodia	...	Rs. 27—28	Rs. 15—20

II. **Groundnut:** (In this section: candy = 531 lb. of kernels bag = 80 lb. of pods)

2-1: *Stocks:* 2-1-1: *South Arcot District:* All the markets of South Arcot district opened with a stock of 7,675 tons at the commencement of the month. Arrivals during the month amounted to 12,398 tons as against 3,777 tons during the previous month. Receipts from other States and districts accounted for 930 and 5,300 tons respectively. Consumption both by oil mills and country *chekkus* amounted to 7,378 tons and 172 tons respectively. Despatches to other districts and States amounted to 3,805 tons and 176 tons respectively. After deducting a quantity of 789 tons the month closed with a stock of 13,983 tons with the trade.

2-2: *Prices:* 2-2-1: *South Arcot District:* The average price of groundnut kernels marketed in the several markets of this district ranged from Rs. 95–6–0 to 102–8–0 per candy of 531 lb.

2-2-2: *Ramanathapuram District:* The opening and closing prices of groundnut pods and kernels that prevailed in the different markets of this district are extracted below:

(Pods: Price per bag of 82 lb.)
(Kernels: Price per candy of 531 lb.)

		Opening	Closing
Pods	...	Rs. 8—10/8	Rs. 9/8—11/8
Kernels	...	Rs. 90—106	Rs. 100—118

III. **Gingelly:** (In this section candy = 168 lb.)

3. *South Arcot District:* 3-1: *Stocks:* All the markets of South Arcot district put together opened with a stock of 650 bags at the beginning of the month. Total arrivals in the month accounted for 1,259 bags out of which 1,066 bags alone were received by Virudhachalam market besides 103 bags from outside the district. Consumption by *chekkus* amounted to 783 bags. Despatches made to other districts during the month accounted for 245 bags. The month closed with a stock of 881 bags.

3-2: *Prices:* The average price of gingelly ranged from Rs. 41—48/2 per bag in this district.

IV. **Coconut and its products:** (In this section: candy = 700 lb.)

4-I: *Coconut:* 4-1-1: *Stocks:* The particulars of stocks transacted in the districts of Malabar and South Kanara are extracted below:

Name of the Market	*Opening balance*	*Arrivals*	*Disposals*	*Closing balance*
Malabar District:				
1. Kozhikode ...	6,100	3,500	3,325	6,275
2. Badagara ...	515	1,626	1,837	304
3. Ponnani ...	550	775	553	775
4. Tellicherry and Dharmadam ...	673	1,152	1,112	713
South Kanara District:				
5. Mangalore ...	110	275	325	60

(Figures in thousand numbers)

4-1-2: *Prices:* (a) Minimum and maximum prices of coconut in the different markets of Malabar district are extracted in the following:

		Maximum	Minimum
1. Kozhikode	...	Rs. 125	Rs. 70
2. Ponnani	...	Rs. 127	Rs. 120
3. Badagara	...	Rs. 145	Rs. 80
4. Tellicherry and Dharmadam	...	Rs. 115	Rs. 100

(Prices per thousand)

(b) The opening and closing prices of coconuts that prevailed in Mangalore market during the month are as follow:

(Prices per thousand)

		Opening	Closing
Raw	...	Rs. 150—170	Rs. 160—165
Dry	...	Rs. 165—215	Rs. 160—210

4-2: *Copra:* 4-2-1: The stock position of copra in Malabar and Mangalore markets is extracted below:

Name of the Market		*Opening balance*	*Receipts*	*Disposals*	*Closing balance*
Malabar District (in candies):					
1. Kozhikode	...	1,233	5,100	3,525	2,808
2. Badagara	...	736	1,910	2,014	632
South Kanara District (in tons):					
3. Mangalore	...	38	180	191	27

4-2-2: *Prices:* (a) The prices of copra in the different markets during the month are extracted below:

Variety		*Price per candy in Rs.* *Kozhikode* Maximum	Minimum	*Badagara* Maximum	Minimum
Office	...	282	277	285	275
Edible	...	325	305	325	318
Madras	...	330	315	325	320
Rajpur	...	455	330	350	345
Gola	...	325	307	—	—

(b) The prices of copra in Mangalore market ranged at Rs. 270—305 per candy.

V. **Arecanut:** (In this section: Bag = 100 lb.)

5-1: *Stocks:* The stock particulars of arecanuts in the markets of Malabar and South Kanara district are extracted below:

Name of the Market (in bags)		*Opening balance*	*Receipts*	*Disposals*	*Closing balance*
Kozhikode	...	2,384	290	1,432	1,242
Ponnani	...	1,800	548	648	1,700
Palghat	...	340	120	130	330
Mangalore (cwts.)	...	3,180	22,300	21,300	4,180

5-2: *Prices:* (a) Prices of arecanut (*choor*) in Palghat market of Malabar district ranged at Rs. 156/- to 165 per bag.

(b) The price ranges of *supari* in Mangalore market as between the different varieties are extracted below:

Variety		*Minimum*	*Maximum*
Koka	...	90	135
Choll	...	175	198
Malabar supari	...	120	140
Mangalore supari	...	120	168

(Prices in Rs. per cwt.)

VI. **Tobacco:** (In this section: candy = 500 lb.)

6-1: *Stocks:* The tobacco market at Tirupur started with an opening balance of 7,625 cdys. of chewing and 1,890 cdys. of cheroot at the commencement of the month. Despatches during the month amounted to 2,437 cdys. of chewing and 1,446 cdys. of cheroot tobacco. The places despatches were mostly Travancore-Cochin State, Palghat, Ramnad, Pudukottai, Malabar, Tanjore, Tiruchirapalli, Chingleput, North Arcot, South Arcot, Pondicherry and Tirunelveli. The month closed with a stock of 6,282 cdys. of chewing and 2,437 cdys. of cheroot.

6-2: *Prices:* (a) Although there was a slight decline in the prices of superior chewing and cheroot tobacco varieties there was an upward trend in the case of all other sorts.

(b) The prices of different varieties of tobacco for different grades in Tirupur market are extracted in the following:

Variety	*I grade*	*II grade*	*III grade*
1. *Chewing, tobacco, sun-cured:*			
(a) Meenampalayam	430—475	350—400	250—305
(b) Other varieties ...	315—360	215—215	150—175
2. Cheroot varieties sun-cured (grown in Erode and Bhavani taluks) ...	360—440	220—350	140—190
3. Chewing varieties pit-cured (grown in Palladam and Sulur areas)	280—325	150—225	120—150

Review of the Activities of the Market Committees during December 1955

1-1: Of the seven Market Committees in the State, only five, in the districts of North Arcot, South Arcot, Coimbatore, Malabar and South Kanara continued to function actively during the month. The activities of the other two Market Committees viz. Ramanathapuram Market Committee and Tirunelveli Market Committee continued to be restrained on account of some legal difficulties.

1-2: A new market of South Arcot Market Committee was opened at Kallakurichi by Sri A. Kunhamed, B. A., Collector of South Arcot district. On the first day of the opening, 1,350 bags of groundnut kernels arrived in the market.

1-3: The following were the licences issued by the Market Committee during the month under Madras Commercial Crops Markets Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A.	B.	A.	B.	A.	B.	A.	B.
North Arcot Market Committee ..	366	2,133	135	761	555	1,113	6	28
South Arcot Market Committee ..	310	..	302	..	332	..	..	..
Coimbatore Market Committee ..	160	872	172	989	46	685	..	8
Malabar Market Committee ..	15	..	74	..	..	..	..	..
South Kanara Market Committee ..	25	259	18	210	2	42	..	..

1-4: The total volume of transactions in commercial c in the 14 regulated markets of the State during December 19 extracted below:

Crop		Quantity	No. of regul markets
Groundnut kernels	..	10,772 tons.	10
Gingelly	..	631 bags.	1
Cotton kapas	..	2,806 pothis.	2
Cotton lint	..	835 candies.	3

(Bag = 168 lb. Pothi = 280 lb.)

II. **Meetings:** No meetings were held in any of the Mar Committees during the month.

III. **Quality Appraisal:** 3-1: The South Arcot Market C mittee continued its work on the quality analysis of ground kernels marked in the district. During the month 344 samples w analysed from out of arrivals 52,699 bags of groundnut kern (bag = 177 lb.) comprised in 9,663 lots. The details of analy which may be of interest, are extracted below:

Particulars		Cudda-lore	Villu-puram	Tindi-vanam	Tiru-koilur	Virdha-chalam	Pan
1. *Dryage:*							
20% below	..	6	..			40	2
above 2% and up to 3%	..	15	..			9	7
above 3% and up to 4%	..	16	2			9	15
above 4% and up to 5%	..	29	3	Analysis not carried out in these two markets, due to heavy arrivals.		11	8
above 5% and 10%	..	60	35			..	49
above 10%	..	11	2			..	15
2. *Total refraction:*							
4% and below	..	18	..			21	12
above 4% and up to 8%	..	79	42			48	65
abeve 8%	..	40	..			..	19

The total common refraction was below 4% in 51 sampl 5 to 8% in 234 samples and above 8% in 59 samples.

5-2: The enlistment of competitors for winter groundnut crop quality competition up to the end of December 1954, is as below:

Cuddalore O. T.	...	21
Panruti	...	20
Villupuram	...	8
Tirukoilur	...	6
Tindivanam	...	1
		56

Crop and Trade Reports

Sugarcane — Intermediate Condition Report — Period up to the end of November, 1955: The condition of the standing crop of sugarcane is reported to be generally fair in all the districts of the State. The yield per acre is expected to be below normal in the district of North Arcot. In Tiruchirapalli district the yield per acre is reported to be below normal due to damage caused by the cyclone in November, 1955. The yield per acre is expected to be normal in all the other districts of the State. The average wholesale price of jaggery per standard maund of 82 2/7 lb. or 3,200 tolas as reported from important market centres on 2—12—1955 was Rs. 13—15—0 in Mangalore, Rs. 10—0—0 in Erode, Rs. 9—6—0 in Tiruchirapalli, Rs. 8—4—0 in Cuddalore, Rs. 7—8—0 in Vellore, and Rs. 6—4—0 in Salem. Compared with the prices which prevailed in the corresponding period of last year, these prices reveal a decrease of 44·3 per cent in Cuddalore, 34·3 per cent in Vellore, 29·6 per cent in Salem, 27·5 per cent in Tiruchirapalli, 9·7 per cent in Mangalore and 4·8 per cent in Erode.

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Editorial

Crabs and Chlorosis: This may be taken as the twentie century version of Darwin's famous correlation between C and Clover. Our readers will find elsewhere in this issue t articles bearing on the subject of chelated compounds in t treatment of chlorosis. The term chelated is derived fr a Greek word *Chela* meanting a claw and indicates the fa that in certain types of complex organic compounds t metallic elements of iron, manganese or copper as the ca may be, are gripped tight as in a crab's claws; gripped fact, so tightly that they no longer exhibit the characteris properties of the free compounds of iron or other elements.

The increasing recognition of nutritional disorders crops and fruit trees has brought into prominence the vari types and manifestations of chlorosis. The most wide prevalent among these is iron chlorosis, otherwise known lime-induced chlorosis. Under conditions where the soil rich in lime, the availability of iron is very much reduce It is believed that phosphorus also plays an important ro in retarding the uptake of iron by plants. Lack of suf cient organic matter in the soil, and inadequate potassiu are also aggravating factors.

The deficiency of iron in plants in calcareous soils not due to any actual deficiency of the element in the soi but is due mainly to its unavailability. It is seldom tha soil dressings of iron compounds like ferrous sulphate provic any relief and the usual and most economical method c correcting the disorder is generally by means of foliar spray using 0·2 to 1% solution of ferrous sulphate. Unfortunatel foliar sprays have to be used with great care and caution, a they often prove injurious to the foliage. In certain case

in Bengal, on different green leaves. The findings in those two places go to show that there is no appreciable difference among the various leaves when tried on equal nitrogen basis. In Nagerkoil green leaves such as *Konnai* (*Cassia florida*) *Pungam*, (*Pongamia glabra*) *Avarai* (*Cassia auriculata*) and *Vahai* (*Albizzia lebbeck*) were tried. It was found that though *Konnai* leaves contained the highest percentage of nitrogen, *Vahai* leaves gave a better response; *Avarai* was second. Similar differences were noted in Kumpta and Karjat Farms of Bombay State. Since these experiments had not conclusively proved the relative efficacy of the green leaves studied, a study was undertaken to assess the relative merits of the commonly used green leaf manures.

Materials and Methods: 1. *Laboratory Studies:* The more important of the green leaves available near about the Institute were collected just after the monsoon when the leaves were fresh and in full flush. The leaves were gathered in the same manner a ryot would do to manure his fields. Soon after collection the stem and leaf portions were separated and their weights recorded. Thus the leaf to stem ratio was available to get an idea of the nature of the material. Original moisture was also estimated to know the succulence. The leaves and stems were sampled and kept in a steam oven to arrest the action of enzymes. After drying they were sampled in the usual way. The kinds of leaves taken up for study were: *Delonix*, *Calotropis*, *Thespesia*, *Gliricidia*, *Pongamia*, *Croton sparsiflorus* and *Sesbania*.

Analytical Technique: The nitrogen content of both the leaf and stem was estimated by the Kjeldahl's method (7) (vide Table I).

The decomposability of the leaf and stem was determined by the method described by Fred and Waksman (7)

Nitrifiability: Nitrifiability of a material indicates the rapidity with which it undergoes decomposition in the soil leading to the formation of nitrates, in which form most plants take up the nitrogen. This was assessed by the usual method, i. e. thirty milligrams of nitrogen in the form of leaf and stem were added separately to 100 grammes of soil which were placed in jam jars under constant optimum moisture level and kept at room temperature (28°C) for six weeks. Samples were analysed periodically to find out the rate of nitrate formation.

2. *Pot Experiments:* Pot experiments were also conducted to test the capacity of the different green leaves on the yield of paddy, as a knowledge of their chemical characteristics alone would not give a complete idea of their relative efficiency. In these tests paddy Co. 25 was grown in pots and crop response was studied to the different green leaf manures, incorporated at 45 lb. nitrogen per acre over a basal application of superphosphate at 30 lb. P_2O_5 per acre. In addition, the performance of the crop due to the green leaves was compared against those raised with ammonium sulphate and groundnut cake on the same nitrogen basis and against "No manure" also.

The experiment was carried out with a typical paddy soil starved of nitrogen for over seven years.

Technique:

(a) *Green Manure:* The green leaves were collected at the time of application, their nitrogen and moisture contents estimated, and the calculated amounts of leaves were applied to the pots, cut into small bits, after duly watering and puddling the soil. Treatments were replicated four times.

(b) *Watering:* A known quantity of water was added to each pot. The amount of water in all the pots was maintained at a constant level throughout the growth period.

(c) *Transplanting:* As is usual under field conditions, the green manure was allowed to rot for one week and one month-old seedlings were transplanted at the rate of eight per pot. The plants that did not get established were replaced with fresh seedlings.

(d) *Observations:* The following observations were recorded:

1. Rate of growth.
2. Tillering.
3. Duration of flowering.
4. Number of panicles.
5. Length of panicle.
6. Number of grains well-set and ill-set, and
7. Weight of 100 grains.

(e) *Harvest:* As the crop matured, the grains were harvested separately and the straw cut close to the roots. They were dried to constant weight and the yield data recorded. (Vide Table VI)

Results: The stem to leaf ratio, moisture content of stem and leaf and decomposability are presented in Table I. It may be seen that *Cassia auriculata* and *Delonix regia* are characterised by high proportion of leaf to stem. The decomposability of *Thespesia* is highest. The original moisture contents of *Sesbania, Gliricidia* and *Calotropis* are very high. Hence these are very succulent green manures.

The nitrogen content and nitrifiability of the leaf and stem are presented in Table II. The nitrogen content of all the green leaves is generally high but *Calotropis, Sesbania, and Croton sparsiflorus* nitrified far more rapidly than the leaves of other varieties. Nitrifiability of *Sesbania* is the highest while *Gliricidia, Calotropis, Croton sparsiflorus* and *Thespesia* may be said to be good.

The nitrogen content and nitrifiability afford the best index of the usefulness of green leaves. Judged by these criteria the value of the green leaf manures studied may be arranged in descending order as follows: *Sesbania speciosa, Gliricidia maculata, Calotropis gigantea, Thespesia populnea, Croton sparsiflorus, Delonix regia, Pongamia glabra, and Cassia auriculata.*

The rate of growth of paddy plants due to different green leaf manures are presented in Table III. It may be seen that in the earlier vegetative stages of growth the plants in *Gliricidia* series were tallest followed by those in groundnut cake series. Plants in ammonium sulphate series were only slightly better than the "No manure" treatment.

During the second fortnight the plants in ammonium sulphate series were tallest and the rate of growth was markedly superior to the rest of the treatments. This superiority was maintained throughout the growth period. This may be due to the fact that the ammonium sulphate being soluble, the nitrogen might not have been available within the reach of the plants till the roots were well developed and the plants were able to assimilate it to the best advantage.

TABLE I

Showing the stem to leaf ratio, original moisture and decomposability.

Green leaf manure	Ratio of stem to leaf	Percentage moisture in green state		Decomposability Mgm. of CO_2 Evolved in 24 hrs.	
		Stem	Leaf	Stem	Leaf
1. Delonix ..	1:3·90	55·85	66·28	..	..
2. Calotropis ..	1:0·80	81·87	85·04	18·37	18·90
3. Thespesia ..	1:2·30	51·53	62·92	29·96	42·35
4. Gliricidia ..	1:1·89	76·95	76·00	17·27	20·13
5. Pongamia ..	1:1·34	54·50	58·70	12·76	13·09
6. Croton sparsiflorus	1:1·20	47·18	64·22	12·91	10·28
7. Cassia ..	1:3 80	42 79	55·58	..	..

The analysis of the other three green leaf manures has not been completed.

TABLE II

Showing nitrogen content and nitrifiability of the different green leaves.

Green leaf manure	Nitrogen percentage (Dry basis)		Nitrifiability of leaf %	Time in weeks
	Stem	Leaf		
1. Delonix ..	1·47	2·27	−3·09	6
2. Calotropis ..	1·40	3·52	23·17	4
3. Thespesia ..	1 56	3·28	21·33	6
4. Gliricidia ..	1·84	3·98	26·67	6
5. Pongamia ..	1·89	3·79	6·13	6
6. Croton sparsiflorus ..	2·10	3·85	23·53	4
7. Sesbania ..	..	..	34·73	4

TABLE III

Showing the rate of growth of paddy due to different green-leaf manures.

(at fortnightly intervals)

Intervals	I	II	III	IV	V	VI	VII	VIII
Treatments:								
1. Delonix ..	51·9	62·4	64·4	65·7	68·7	77·9	100·6	103·3
2. Calotropis ..	49·6	57·5	58·6	61·9	63·8	70·2	89·9	91·8
3. Thespesia ..	51·9	54·1	56·2	57·4	50 4	67 9	85·5	90·5
4. Datura ..	50·7	54·2	57·6	60·8	62·0	67·8	77·3	90·1
5. Gliricidia ..	58·1	59·6	63·9	68·0	68·4	75·6	96·6	98·3
6. Pongamia ..	50·2	55·7	58·6	62·2	63·6	70·7	89·7	89·3
7. Croton sparsiflorus ..	52·1	53·6	60·5	63·3	64·0	72·1	90·9	97·2
8. Cassia ..	49·4	56 7	63·2	65·2	67·7	80·6	98·8	100·6
9. Sesbania ..	50·3	56·5	60·8	64·1	65·6	72·9	93·1	95·6
10. Enterolobium ..	47·6	55·6	62·5	64·3	68·8	76·3	96·3	98·7
11. Groundnut cake ..	55·1	58·6	64 3	68·0	69·7	79·5	97·6	97·2
12. Ammonium sulphate ..	47·0	65·5	74·6	77·1	82·7	94·1	109·7	113·1
13. No manure ..	45·1	48·6	51·7	54·2	55·3	61·0	76·2	81·9

The vegetative characters are presented in Table IV. In the matter of tillering also the ammonium sulphate series was again the best, followed by *Delonix*. The rest of the treatments were about the same.

TABLE IV.

Showing the vegetative characters due to different treatments.

Treatments	Average number of tillers	Average number of earheads	Length of earhead in cms.
1. Delonix ..	2·25	11·8	19·38
2. Calotropis ..	1·88	10·0	17·37
3. Thespesia ..	1·68	10·0	16·56
4. Datura ..	1·68	10·5	16·75
5. Gliricidia ..	1·63	10·3	17·56
6. Pongamia ..	1·88	10·8	18·56
7. Croton sparsiflorus ..	1·75	9·5	14·12
8. Cassia ..	1·78	9·3	19·69
9. Sesbania ..	1·75	10·5	18·44
10. Enterolobium ..	1·78	9·8	18·38
11. Groundnut cake ..	2·20	9·8	18·31
12. Ammonium sulphate ..	3·60	21·5	19·38
13. No manure (control) ..	1·33	9·0	16·81

Flowering was observed in all the treatments simultaneously except in the ammonium sulphate series which was delayed by a couple of days. The duration of flowering was five days in almost all cases. The maximum earhead formation was in the ammonium sulphate treatment; *Delonix* occupying the second place. In the matter of length of earhead, however, the *Cassia* series topped the list followed by ammonium sulphate and *Delonix*. The maximum number of grains was found in the *Cassia* series followed by ammonium sulphate series. Groundnut cake ranked third and the other series such as *Pongamia*, *Sesbania*, *Gliricidia*, and *Croton sparsiflorus* were fairly good. (Table V). But the proportion of well-set grains to ill-set grains was highest in ammonium sulphate series (85·96%) followed closely by groundnut cake and *Cassia* series. *Delonix* and *Thespesia* were the poorest in this respect.

In the matter of yield of grain ammonium sulphate ranked first, being distinctly superior to the rest of the treatments with an increase in yield of 304% of grain and 283% of straw over the "No manure". Among the green leaves there was no significant difference in yield. In regard to straw also, ammonium sulphate ranked as the first (Vide Table VI.)

TABLE V

Showing the number of grains per earhead in each series with the percentage of well-set and ill-set grains

Treatments		Well-set	Ill-set	Total	Well-set %	Ill-set %
1. Delonix	..	68·9	32·4	101·3	68·03	31·97
2. Calotropis	..	68·3	22·3	90·6	75·39	24·61
3. Thespesia	..	49·1	23·8	72·0	67·36	32·64
4. Datura	..	64·1	17·4	81·5	78·65	21·35
5. Gliricidia	..	80·0	29·5	109·5	73·05	26·95
6. Pongamia	..	88·0	29·4	109·1	80·67	19·33
7. Croton sparsiflorus	..	95·5	21·1	117·4	81·34	19·36
8. Cassia	..	104·3	21·9	126·2	82·62	17·38
9. Sesbania	..	74·3	26·7	100·4	74·01	25·99
10. Enterolobium	..	83·3	25·5	108·8	76·54	23·46
11. Groundnut cake	..	101·1	20·6	121·7	83·08	16·92
12. Ammonium sulphate	..	107·0	17·5	124·5	85·96	14·04
13. No manure	..	55·8	17·8	73·6	75·80	24·20

(Average value of 8 ear-heads per series)

TABLE VI.

Showing the summary of results of the comparative manurial values of various green leaf manures for paddy. (Pot-culture experiments)

Treatments		Particulars			
		Grain		Straw	
		Average yield per pot	Percentage on control	Average yield per pot	Percentage on control
1. Delonix	..	11·48	168·8	23·25	193·9
2. Calotropis	..	8·15	119·9	15·75	131·3
3. Thespesia	..	6·98	102·6	16·75	139·6
4. Datura	..	8·73	128·3	16·75	139·6
5. Gliricidia	..	9·75	143·4	19·00	158·3
6. Pongamia	..	9·53	140·1	15·75	131·3
7. Croton	..	11·08	162·9	18·00	150·0
8. Cassia	..	12·25	180·1	20·25	168·8
9. Sesbania	..	8·23	121·0	19·00	158·4
10. Enterolobium	..	10·78	158·4	19·75	164·6
11. Groundnut cake	..	11·08	162·9	19·50	162·5
12. Ammonium sulphate	..	27·43	399·6	46·00	383·3
13. No manure	..	6·80	100·0	12·00	100·0
General-mean	..	10·94		20·14	
Standard error	..	1·65		4·88	
'Z' test satisfied or not		Yes		Yes	
Critical difference at 1·0% level	..	4·9		13·27	

Conclusion :— GRAIN : 12 8 1 7 11 10 5 6 4 9 2 3 13

STRAW : 12 1 8 10 11 9 5 7 4 3 2 6 13

The weight of 100 grains of paddy from the different treatments are presented in Table VII. The weight of grains obtained from *Croton sparsiflorus* and *Cassia auriculata* was distinctly greater than the rest. Grains from *Calotropis* and *Thespesia* were distinctly poorer in weight and there was no significant difference between the other treatments. Ammonium sulphate, therefore, is noted not to have influenced the weight of grain. This, it has made up by the increased number of well-set grains per panicle and increased branching of the panicle.

From the data it is clear that ammonium sulphate is far superior to the green leaf manures in the matter of yield of grain and straw when applied on equal nitrogen basis. The factor responsible for the increased yield is evidently due to the readily-available nitrogen supplied by ammonium sulphate. Such an indication was also noted by Karunakar et. al (8).

Regarding the source of organic nitrogen in the form of different green leaves, the variety of green leaf has no material influence on the yield of paddy among themselves but, compared with "No manure" the green leaf manures have definitely increased the yield.

Summary and Conclusions:

(1) The stem to leaf ratio, original moisture content, nitrifiability and decomposability of the different green leaves were determined.

(2) The growth characteristics and the yield behaviour of the paddy crop due to the application of the different green leaf manures were studied in pots.

(3) Ammonium sulphate was found to be distinctly superior to any organic nitrogen supplied, in the form of green leaf manures and groundnut cake.

(4) Ammonium sulphate was found to significantly increase the yield of grain and straw.

(5) Grain weight with ammonium sulphate was significantly less; that with *Delonix* being the best.

(6) Supply of readily available nitrogen as in the case of ammonium sulphate may be taken as the factor influencing high yield.

(7) While application of green leaves gives enhanced yields generally, the variety of green leaves applied has no influence on the increase of yield.

(8) Ammonium sulphate is more quick-acting than green manure, but green manures are a cheaper source of nitrogen supply. The evidence, therefore, points to a combination of ammonium sulphate plus green manure as the most efficient and economical way of supplying nitrogen to paddy.

TABLE VII

Showing the weight of 100 paddy grains from the different green-leaf manure series

Treatments	Particulars	
	Average weight of grains	Increase or decrease in weight over control
A. Delonix	1·777	99·72
B. Calotropis	1·743	98·17
C. Thespesia	1·740	98·02
D. Datura	1·783	102·30
E. Gliricidia	1·775	100·00
F. Pongamia	1·775	100·00
G. Croton sparsiflorus	1·863	105·00
H. Cassia	1·835	103·40
I. Sesbania	1·795	101·10
J. Enterolobium	1·813	102·10
K. Groundnut cake	1·765	99·65
L. Ammonium sulphate	1·783	102·30
M. No manure	1·775	(100·00)
General Mean	1·786	
Standard error	0·00774	
'Z' test satisfied or not	Yes	
Critical difference at 1% level	0·021	

Conclusions:— G H J I L D A E F M K B C

List of botanical names of the green-leaf manures used in this experiment

1. *Delonix regia* Rafin
2. *Calotropis gigantea* R. Br.
3. *Thespesia populnea* Soland
4. *Datura Metel*
5. *Gliricidia sepium* Steud (*Gliricidia maculata* H. B. K.)
6. *Pongamia glabra* Vent.
7. *Croton sparsiflorus* Mor.
8. *Cassia auriculata* Linn.
9. *Sesbania speciosa* Soland
10. *Enterolobium saman* Prain

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Chelates in Agriculture — Sequestrenes and Versenols of Commerce

(A Review)

by

T. SESHAGIRI & A. MARIAKULANDAI

It has been recently discovered that iron chlorosis in fruits and garden crops could be completely cured by the use of certain complex organic iron compounds known as "iron chelates". The metallic elements in this complex form are referred to technically as being "chelated", or "sequestered" to denote the manner in which

the iron is combined with the organic fractions. 'Chelate' is a term derived from a Greek word meaning 'a claw'. These compounds combine with the metal in such a manner that the metal no longer exhibits the typical properties of the free compounds of the element (Bould, 1955, Allerton, 1955)

There are various causes attributed to chlorosis in plants and of these lime-induced iron chlorosis is the most common. Certain plants growing on a naturally calcareous soil are susceptible to chlorosis. In such cases, the soil and plant factors are such that iron is not in a form that can be utilized by the plant. Chlorotic leaves do not necessarily contain low amounts of iron, but, owing to adverse conditions within the plant cells, the iron is not available for chlorophyll formation. It is inactive and immobile. There exists an improper micronutrient balance. (Pierce and Alexander Hall, 1955.)

It is generally recognised that lime-induced chlorosis is difficult to cure. The use of inorganic salts of iron, either as leaf sprays or soil dressings has met with only partial success, for, although some intake and absorption of iron occurs, it is rapidly made unavailable. Even the radio-iron added to the soils was fixed in the soil to such a degree as to make it unavailable to the plants. (Holmes and Brown, 1955).

The use of iron chelates in this connection has aroused considerable interest. Some of the chelating agents in use are :

	Name	*Abbreviation*
1.	Diethyl-ethylene-triamine-penta-acetic Acid	DTPA
2.	Ethylene-diamine-tetra-acetic Acid	EDTA
3.	Hydroxy-ethyl-ethylene-diamine-triacetic Acid	HEEDTA
4.	Cyclohexane–1, 2–Diamino-tetra-acetic Acid	CDTA
5.	An Aromatic Amine (name not known)	138

For convenience these compounds are referred to by their abbreviations. If iron is combined with these compounds they are referred to as 'Chelated' e. g., Fe–EDTA, Fe–DTPA, etc ; Otherwise they are just referred as 'Chelates' e. g. EDTA., DTPA, etc. These compounds dissolve freely to form pale-coloured solutions. The chemical characteristics of these compounds are not uniform nor is their behaviour in soils and on all crops the same. Some are stable in acid conditions, some others in alkaline conditions, some get fixed in the soil to a greater degree and so on. The use

of chelates with or without iron is both common. Leaf sprays have not proved successful. When used as soil dressings, the chelates have yielded good results. Even in minute quantities the chelates have a good effect and within a few weeks after application the full green colour of the leaves returned even in the most chlorotic leaves, (Wallace et. al. 1955, Bould June 1955, Cooper 1955, Holmes and Brown, 1955). With time the effectiveness of the chelate decreased, and hence for this reason and also to prevent it from getting fixed up in the clay, the chelate is applied just when chlorotic symptoms become manifest. (Holmes and Brown, 1955).

The mechanism of the behaviour of chelates is not well understood at present. The chelates when applied, even without Fe, have been able to activate iron in the soil and make it available to the plant. There is also evidence that the chelate molecule enters the plant and releases the immobile iron. The iron chelate also enters the plant and immediately the iron gets released for plant use. Some chelated iron compounds are found effective in decreasing the absorption and translocation of manganese and copper in the plant, while increasing the availability of iron, and thus restore the micro-element balance. (Wallace et al. 1955, Holmes and Brown, 1955)

There are possibilities of chelating these organic compounds with other microelements and extending their use to cure respective microelement deficiencies. In fact, attempts have already begun to prepare manganese chelates. Thus the use of chelates has great possibilities and is likely to play a very significant part in the treatment of micro-element deficiencies.

The chelated compounds are put on the market by various trade names like "Sequestrenes" "Versenols" etc. by different companies.

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Quicker and Better Germination in Snakegourd and Bittergourd

It is found that the seeds of Snakegourd *(Trichosanthes anguina)* and Bittergourd *(Momordica charantia)* take six to ten days to germinate and the germination percentage normally does not exceed 78%. With a view to hasten the germination of these seeds, trials were conducted at the Agricultural Research Station, Aduturai with the following treatments during the pre-storage period and just before sowing the seeds.

(1) The seeds after extraction were washed in water, mixed with cowdung and cast into cakes or 'bratties'. These cakes were allowed to dry on the walls of a building and removed from the wall after ten or twelve days when the seeds were completely dry and stored in tin containers.

(2) After extraction and washing in water the seeds were mixed with ash and dried in the sun for a day afterwards in the shade till the seeds were completely dry and stored in tin containers.

(3) As generally practised, the seeds after collection were washed in water, dried in the sun for a day and afterwards in the shade till the seeds were completely dry and stored in tin containers.

(4) Seeds treated as in (3) were soaked in cowdung emulsion for 24 hours just before sowing.

The seeds of snakegourd and bittergourd were extracted during the third week of April and after the treatments in the pre-storage period as mentioned above were stored till they were required for sowing during the third week of June.

The seeds treated by the above methods, were dibbled in pits of 1½ feet diameter and 1½ feet in depth during the third week of June. Seven seeds were dibbled in each pit and thirty pits were put under each treatment. The date of commencement of germination, the number of seeds germinated and the date of completion of germination under each treatment were noted daily. On the same date of sowing of the seeds in pits, fifty seeds of both snakegourd and bittergourd under each treatment were sown at distances of six inches either way in well-prepared plots in duplicate and the date of commencement of germination, the number of seeds germinated and the date of completion of germination were similarly observed. The details of germination of seeds sown

in pits and in the observation plots are furnished in Tables I and II below.

TABLE I

Details of germination of snakegourd seeds:—

1. Date of extraction of seeds 24—4—55.
2. Date of sowing 23—6—55.
3. Total number of seeds sown in 30 pits under each treatment 210.
4. Total number of seeds sown in observation plots under each treatment 50 in each replication.
5. Treatments:—(1) Seeds kept in cowdung cake, (2) Seeds mixed with ash, (3) Seeds stored after washing and drying, (4) Seeds stored as in (3) were soaked in cowdung emulsion for 24 hours just before sowing.

Date	Pits Treatments				Observation plots Treatments							
	1	2	3	4	1		2		3		4	
					I	II	I	II	I	II	I	II
24—6—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
25—6—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
26—6—55	nil	nii	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
27—6—55	79	9	nil	12	7	9	2	3	nil	nil	5	5
28—6—55	108	27	28	49	34	34	18	18	13	10	22	24
29—6—55	12	95	73	75	5	3	9	8	8	10	8	7
30—6—55	nil	30	29	49	nil	1	4	3	4	5	6	6
1—7—55	nil	12	12	11	nil	nil	3	4	1	2	5	3
2—7—55	nil	nil	5	nil	nil	nil	1	2	2	nil	nil	1
3—7—55	nil	nil	4	nil	nil	nil	nil	nil	2	2	nil	nil
4—7—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Total	199	173	151	196	46	47	37	38	30	29	46	46
Percentage of germination	94·8	82·4	71·9	93·3	93·0		75		59		92	

It is seen that the seeds of snakegourd and bittergourd preserved in cowdung cakes start germinating three days after sowing and completes germination within another three days. The seeds soaked in cowdung emulsion and the seeds mixed with ash commence germinating three days after sowing and take five days to complete germination while the seeds stored in the usual method, that is, after washing and drying, germinate after five to six days of sowing and take six to seven days to complete germination. It is also seen that germination percentage is more for the seeds preserved in cowdung cake and for seeds soaked in cowdung emulsion just before sowing. The germination percentage is least for the seeds stored in the usual method.

TABLE II

Details of germination of bitter-gourd seeds:—

Date of extraction of seed, date of sowing, total number of seeds sown in pits and in observation plots and the treatments are same as in the case of snakegourd.

Date	Pits Treatments				Observation plots Treatments							
	1	2	3	4	1		2		3		4	
					I	II	I	II	I	II	I	II
24—6—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
25—6—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
25—6—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
27—6—55	80	4	nil	10	15	18	2	2	nil	nil	1	3
28—6—55	109	33	31	92	29	25	10	12	9	7	23	24
29—6—55	9	78	69	59	3	4	17	18	10	9	12	12
30—6—55	nil	50	45	20	nil	nil	5	6	4	8	5	5
1—7—55	nil	12	7	3	nil	nil	nil	nil	nil	3	3	2
2—7—55	nil	nil	8	nil	nil	nil	nil	nil	3	3	nil	nil
3—7—55	nil	nil	3	nil	fiil	nil	nil	nil	3	3	nil	nil
4—7—55	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil	nil
Total	198	177	163	184	47	47	34	38	29	33	44	46
Percentage of germination	94·3	84·3	77·6	87·6	94		72		62		90	

Thus with regard to quickness in germination, rate of germination and better germination seeds kept in cowdung cake are found to be the best, followed by the seeds soaked in cowdung emulsion. Mixing the seeds with ash helps to improve and hasten germination to some extent.

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[The "cowdung and wood-ash" methods of preserving snake-gourd and bitter-gourd seeds are in common use, as traditional methods in villages. —*Ed.*]

A High-Yielding White-Grained Ragi

Ragi - *(Eleusine coracana)* is an important millet grown over almost all the States of the Indian Union. In Madras alone, it is grown on an area of about 1·5 million acres and the estimated annual production is 5·9 lakhs of tons of grain. The crop is raised both under rainfed and irrigated conditions and being not season-bound it can be cultivated throughout the year, if sufficient irrigations could be provided.

As a food grain, Ragi is considered highly nutritious, particularly because of its higher calcium content and unlike other millets its use is not limited to the low income groups of the population. The colour of the grain in the common varieties of Ragi is brown of different shades and unless special methods of processing are adopted this undesirable tint is imparted to preparations made out of it. Though the variation in colour of the grain in this millet is the least compared to others, it has been observed that varieties which possess white grains also exist in particular localities. In the collection of different varieties studied at the Millet Breeding Station, a few from Tirunelveli district in the Madras State and some from the Mysore State were found to have this character. The white-grained varieties were, however, very poor in their yielding capacity, compared to the common brown-grained varieties, but the quality of grain was much superior, being higher in protein and vitamin content and having better malting qualities (Sastry - 1939). It has been observed in previous studies that the colour of the grain in ragi is inherited in a Mendelian fashion, being dependent on two independent factors and the white being recessive (Rangaswamy Ayyangar et al 1931). In view of the fact that a white ragi grain will be preferred by the consumer because of its superior qualities, and consequently will fetch a better price to the grower, attempts were made to evolve a high-yielding white-grained strain of ragi by resorting to hybridisation.

Evolution of the white-grained ragi E. C. 4310: As a result of earlier studies, a selection E. C. 1940, higher yielding than the original white-grained varieties had been isolated from crosses between a white-grained selection E. C. 1008 and some of the brown-grained types (Ann. Rept. Madras Ag. Dept. 44—48). E. C. 1540 matures in about 120 days and gives an average yield of only 900 lb. per acre, while the normal brown-grained strains have an yield of more than 2000 lb. grain per acre. This white-grained selection was also found to have an appreciably higher percentage of vitamin B_1 content than Co. 1, a brown-grained one, the percentage in E. C. 1540 being 6·5 μg/g and that in Co. 1 being only 3 7 μg/g (Passmore and Sundararajan 1941). It was considered desirable to use this selection as one of the parents and step up its yield by hybridisation. A number of high yielding brown-grained types were, therefore, crossed with E. C. 1540 and progenies in successive generations were studied and selection with reference to tillering, earhead-shape, duration and yield.

A total number of 90 selections were studied and out of these, two viz., E. C. 4310 and E. C. 4455 (progency of a cross between E. C. 1540 and E. C. 985) were found worthy of further tests. There were compared in yield trials with E. C. 1540, the white-grained parent in 1947 and with Co. 2, the short duration strain (brown-grain) in 1948 and 1949. They were longer in duration than Co. 2 by 10 days and

therefore were tested against the standard Co. 1 (brown grain) in 1951. The yield trials were all conducted at the Millet Breeding Station, under irrigated conditions. The summary of the yield trials is given below:—

Results of yield trials of white-grained ragi selections (in lb./acre)

Year of trial	Selections					Differences significant or not	Critical difference
	E. C. 1540	E. C. 4310	E. C. 4445	Co. 1	Co. 2		
1947	711	1144	1122	..	..	Yes	106
1948	..	537	468	..	1335	Yes	88
1949	937	1304	1013	..	861	Yes	139
1951	..	1687	..	1974	..	Yes	298

Note:— (1) Results of trials from 1947 onwards only are presented.

(2) The yields of Ragi at the Millet Breeding Station in these years were very poor, due to want of irrigation facilities and adequate rainfall.

It may be observed that compared to E. C. 1540, the white-grained parent, the selections E. C. 4310 and E. C. 4455 have given increased yields of more than 20% grain in 1947. In comparison with Co. 2, the short-duration, brown-grained strain, E. C. 4310 was significantly superior and E. C. 4455 equal to it in the trials of 1949. They were however, longer in duration than Co. 2 by 10 days. Further trials with E. C. 4310, the better of the two selections, in comparison with Co. 1, gave conclusive proof of their high-yielding capacity, as may be observed from the results obtained in 1951, wherein it is seen to be on a par with Co. 1 in the yield of grain.

The selection E. C. 4310 was sent out for trial at the Agricultural Research Station, Hagari and the Agricultural Research Station, Palur in 1952. At Hagari an yield of 1953 lb. of grain was recorded for the new strain in comparison with H. 1 which yielded only 1593 lb. while at Palur an yield of 494 lb. of grain per acre was obtained as against 600 lb. for P. 1 the standard strain of the Station. The selection is under intensive tests in the districts of Tiruchirapalli, Salem and Coimbatore and the results are awaited.

The new strain of ragi E. C. 4310 is non-pigmented and white-grained, with top-curved earheads and a maturity period of 120 days. The chemical analysis of the grain has shown that it has a higher content of protein than Co. 1. E. C. 4310 has 8·4% of protein compared to Co. 1 which has only 7·5%. The malting qualities and the vitamin content of this new strain have not yet been studied and investigations in this direction will be taken up separately.

Summary: The commonly cultivated varieties of ragi are brown-grained. The evolution of a white-grained strain of ragi with high

yielding capacity, by hybridisation between poor yielding white-grained types and selections from common high yielding brown-grained varieties is reported. The new strain is superior in quality of its grain and is expected to have a quick spread because of its high yield, absence of colour in the grain and the higher protein content.

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Extracted Article

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A Recent Advance in the Correction of Trace Element Deficiencies

by

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There has for long been recognition that, whereas the "fertilizer" elements, nitrogen, phosphorus and potassium constitute the main nutrient requirements from the quantitative point of view, at leat another nine elements figure in the basic make-up of all plants.

These are sometimes loosely referred to under the collective term of "trace" or "minor" elements but, in fact, three of them, calcium, magnesium and sulphur, are more correctly defined as "intermediate" elements of plant nutrition as they are required in smaller quantities than the fertilizer elements but in considerably larger amounts than the strictly trace elements, iron, manganese, boron, zinc, copper and molybdenum. It is with these latter in general and certain of them in particular that I am concerned in this article.

Now, chemical analysis shows that by far the greatest proportion of soils have reserves of the trace elements sufficient to supply the needs of crops for an indefinitely long period of years. That tracc element deficiencies do arise quite frequently in a wide range of plants is generally due to an insufficient availability of the reserves to supply even the quite small requirements of these elements.

This is a fact of fundamental importance since it leads logically to the conclusion that factors antagonistic to trace element availability can exist in otherwise fertile soils.

This circumstance is, indeed, verified beyond all doubt by the results of countless experiments over the years which have been concerned with the influence of liming on fertility.

Thus, parallel to the very generally recorded increase in fertiliser element availability resulting from the application of lime in some form, especially with highly organic soils, has been the frequent observation that deficient trace element uptake appears in the wake of a rise in the soil pH due to liming.

It has been shown that the availability of all the trace elements decrease as the pH figure reaches and exceeds neutrality, with the exception of molybdenum. In certain cases, e. g. manganese, the effect of high pH is greater when the organic content of the soil is high. The other major factor influencing the availability of the metallic trace elements is, according to increasingly impressive evidence, the level of available phosphoric acid. In theory this is logical since the phosphates of these elements are of the same order of insolubility as the basic carbonate complexes considered to be formed under conditions of alkalinity.

It would seem then that we are concerned with potential plant deficiencies of iron, manganese, boron, copper and zinc (a) wherever the soil is naturally limy or where liming has carried the pH above the 6·3—6·5 mark which is optimum for the growth of the great majority of our plants, and (b) where, as

under conditions of heavy "balanced" fertilizer application, phosphates accumulate.

In practice however, iron and manganese are the only trace elements, required in such quantities that excessive free lime or available phosphates are likely to reduce their availability to the plant to a degree sufficient to give rise to significant deficiencies.

Over the years, at least in this country, biochemists have been mainly concerned with induced deficiencies of these two elements and it is in this regard that significant advance has recently been made.

In 1952, Stewart and Leonard of the Florida Citrus Experimental Station, Lake Alfred, published a report in the Citrus Magazine dealing with the causes and control of iron chlorosis.

They had extended to use on iron-deficient orange trees under field conditions, the discovery by Jacobsen that the essential iron supply could be maintained in soil-less culture solutions by the use of the ferric salt of an organic complex, ethylenediamine tetra-acetic acid (EDTA).

When used as a dormant season soil application to citrus showing the typical chlorosis and branch die-back of severe iron deficiency, the full green colour of the leaves returned within six weeks and vigorous new extension growth was soon apparent. As little as two ounces of actual iron in this organic form per tree had performed what 15 pounds per tree of sulphate of iron had failed to do.

This work was extended with the co-operation of the Alrose Chemical Co., Providence, a subsidiary of Geigy, and it was through the Geigy Company Ltd. of Manchester that EDTA metallic trace element compounds were first made available for experimental work in this country in the winter of 1952.

The first name given to this form of preparation was "Sequestrol" and this became a registered trade mark of the Geigy Company. Later, by general agreement, the name "Sequestrene iron"* was substituted, and to day reference is invariably made to "Seqestrene iron", Sequestrene manganese" and so on.

(* "Sequestrene" and Sequestrene Plus" are registered trade marks of the Geigy Company Ltd.)

The metallic elements in this complex form are referred to technically as being chelated — a term derived from a Greek word meaning "a claw".

Both terms — sequestered and chelated — refer to the property of EDTA and allied compounds of isolating or gripping the metal in such a manner that it no longer exhibits the typical properties of the free compounds of the element.

Thus, for example, if sulphate of iron is dissolved in water and a solution of lime is added, a bulky brownish, insoluble precipitate is formed. When Sequestrene iron is treated in the same manner there is no immediate precipitate and breakdown of the complex is slow.

Another range of chelated metallic trace elements has been developed in Sweden under the name of Versenols. It is claimed that they are more effective under very alkaline conditions than the Sequestrenes, but, as yet, little work appears to have been done with them in this country.

I was privileged to have some of the earliest supplies of Sequestrene iron, and work carried out on Hydrangeas, in conjunction with Cheshunt Research Station, led to the Hydrangea experimental exhibit at Chelsea Flower Show two years ago which readers will doubtless remember seeing.

This particular plant was chosen for the original tests because the foliage shows such obvious yellowing or chlorosis when the pH of the pot soil rises much above six as, in fact, it frequently does due to continual use of "hard" mains water.

Within ten days plants which were so chlorotic as to be almost devoid of green colour, were visibly returning to a normal condition. It should be noted, however, that, whereas a very quick and persistent effect is achieved in regard to the foliage, pink varieties are not "blued" by Sequestrene iron. This would appear to confirm the theory that "blueing" of pink Hydrangeas results mainly from pH changes in the cell sap.

Plants which have been "blued" with the usual iron/aluminium compound are often greatly improved in foliage colour by the use of Sequestrene iron, and it has been noted that the intensity and clarity of the blue colour is sometimes markedly enhanced where Sequestrene aluminium is applied at the stage when the inflorescence is just visible.

Other plants which have been found to react favourably are various Primulas, Camellias, Azaleas and Rhododendrons, *Solanum capsicattrum,* decorative vines, chrysanthemums, tomatoes and a number of soft and top fruit crops.

The method of applicatian varies somewhat with the subject being treated for chlorosis, but it has been found both satisfactory and convenient to standardize the strength of solution at 1 in 1000, i. e., approximately 1 oz. in 6 gallons of water.

Sequestrene iron dissolves freely to form a pale-brown solution which is stable for at least a period of seven days even in hard water.

With pot plants the solution is used to the extent of a light watering on already moist soil. Row crops, such as raspberries and strawberries, are treated at the rate of 1–2 gallons per yard run of row, preferably when the soils is already moist and when growth is fully active in the spring.

Plants which can be treated individually, such as tomatoes and chrysanthemums growing in the border or field soil, are best treated by applying 1—4 pints of the solution per plant. according to circumstances. Where an area is closely planted, as, for example, in bedding schemes, it is satisfactary to apply 1—2 gallons of solution per square yard.

The necessity for or frequency of, repeat doses must, at the present stage of knowledge, be determined by the appearance of the plants, and much work remains to be done on this complex aspect of trace element deficiency correction with Sequestrenes.

During the course of considerable work over the last two years, there has been no evidence that damage can arise from soil treatment on the lines indicated above. It is important, however, that the solution be kept off the foliage, or that the solution contacting low growing plants be washed off before it is dry, with plain water.

Even in Sequestrene form, iron causes appreciable scorching of growth at the I in 1,000 strength, and, though this tendency can be minimized by the addition of a wetting agent, foliage application of the Sequestrenes is not recommended on grounds of safety as well as of efficiency.

A limited amount of work has been done in connection with trees, including orchard top fruits. Several instances have been recorded where application of Sequestrene iron at 2-8 ozs. per tree, dissolved in a convenient quantity of water for application has resulted in a marked improvement in colour of the foliage and in the vigour of growth.

In order to reach the area of maximum surface root activity, application in a broad band between the rows in early spring seems satisfactory. With individual trees or bushes. treatment of the whole area overshadowed by the branches is often advisable, and, in such instances, 1—2 gallons of solution per square yard is indicated.

Most of the information so far to hand concerns Sequestrene iron. Work is progressing with the Sequestrenes of manganese and other metallic trace elements, but it is premature yet to attempt precise recommendations.

In a number of cases, however, manganese deficiency has been found to run parallel to that of iron and, to take account of this circumstance and to give the gardener an opportunity of using the Sequestrenes under his own conditions, a Sequestrene mixture has recently been made available through retail sources. This material has been named "Sequestrene Plus", and is based on the Sequestrenes of iron and manganses together with active magnesium. It should have very general application, particularly on chalky soils, and is used as already indicated for Sequestrne iron, but at the more convenient amateur strength of 1 oz. per gallon of water.

It will be apparent that so complex a subject as the correction of trace element deficiencies cannot be covered in more than very brief detail in the course of one article, but a sufficient indication may have been given of the trend of progress as instanced by the discovery and application of the Sequestrenes. Much, very much, remains to be done, but we would appear to have in these materials a most valuable new approach to a problem which has for long ranked as one of prime importance in the effective culture of our garden. orchard and glasshouse crops.

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Plant Physiol. **26**, *511 - 413*, *(1951)*.

Extracts

The Work at the Birbal Sahni Institute of Palaeobotany, Lucknow

Introduction: It would perhaps be well to mention first how fossils are preserved in the rocks as records of the past. During the time which elapsed between the cooling of the earth and the present day, the earth's crust has experienced widespread changes in its topography, as changes in the distribution of water and land, or by elevation of submerged land and submergence of the of the land areas. During the periods of quiescence lands and mountains have been eroded by rivers and ice sheets and the sediments, along with plant and animal remains brought by them, were laid down at the bottom of the lakes and oceans. These sediments were then transformed into rocks, with plant and animal remains preserved in them as fossils. Rocks of such origin are called sedimentary rocks. These sedimentary rocks have been divided into well-marked epochs on the basis of their fossil contents.

GROUP I. Research of the Form and Structure of Ancient Plants.

Cambrian: (About 553 million years ago): In the Vindhyan rocks plant remains belonging to Algae and Fungi has been discovered by Sitholey, Varma and Srivastava. In a published paper they have described these plant remains and have remarked on their affinities and the age of these rocks in the light of their discoveries.

Devonian: (About 354 million years ago). Some plant fragments consisting of axes with spreading, undivided spines were discovered in the Devonian rocks of Norway by Hoeg. These plants showed an affinity with a group of early land plants called Psilophytes.

Carboniferous: (About 309 million years ago). Morphological studies on *Botryopteris antiqua*, one of the earliest ferns, and *Stauropteris burntislandica* have been publshed by Surange. From these studies he has been able to show that these early plants did not possess flat leaves as in modern plants but possessed just a branch system. He has also discussed the evolutionary trends in these plants and the habitat in which these plants grew.

Permian: (About 223 million years ago). From one of the coal seams in in West Bokara coal-field (Bihar), have been discovered shoots, leaves and seeds of a conifer *Walkomiella* by Surange and Prem Singh. This conifer was known so far only from Australia. Surange, Srivastava and Prem Singh have obtained microspores, megaspores and wood pieces from some coal seams of Bokara (Bihar) on the basis of which they have made an attempt to correlate different coal seams in that area. The presence of an Equisetalean cone in the Raniganj coal field has been recorded by Srivastava. In another paper Surange, Srivastava and Prem Singh have published megaspore types recovered by them in different coal seams of the West Bokara coal-field. Some coal samples from Jharia coal-field have been analysed by Uttam Prakash. He was successful in correlating one unknown seam with a certain coal seam in that area. A study of the stratigraphy and palaeobotany of South Rewa Gondwana has been made by Lele who has made an interesting study of the plants in the Parsora beds, enabling him to collect some evidence as regards the age of Parsora beds which is in dispute for a long time. A collection of plant fossils from China has been worked out by Hsu and Bose who have found a stem which they have named as *Cordaites Sahnii*. Some new plants and two winged pollen grains have been discovered in the Permian rocks of Salt Range by Sitholey. Fossil algae from the Salt Range have been studied by Rao and Varma.

Jurassic: (About 157 million years ago). A collection from Rajmahal, Bihar, has revealed the presence of a male flower of *Williamsonia* which has been named by Sitholey and Bose as *W. santalensis.* A number of woods belonging to conifers and not known previously from Rajmahal have been studied by Bhardwaj, who has described four new species viz., *Taxevlon rajmahalense, Mesembrioxylon indicum, Cupressinoxylon rajmahalense and Dedoxylon jurassicum.* Further study was done on *Homexylon rajmahalense* the problematical plant first described by Professor Sahni, by Hsu and Bose. Some Coniferous cones from Rajmahal were studied by Bose who refers them doubtfully to Brachyphyllum. He has also published his studies on *Bucklandia Sahnii,* the stem of *Williamsonia* brachyphyllum and on a fossil Cycadean stem. Studies made by Shah on a Rajmahal collection show the presence of *Ginkgoites,* the fossil representative of the living and famous sacred tree of Japan, *Ginkgo biloba,* for the first time from this area and he has also established the presence of three different species. Yet another collection was studied by Mittre who has published the presence of Charophytic remains and described male flowers and female cones belonging to *Pentoxyleae,* a new group of Gymnosperms established by Professor Sahni. A collection from a Rajmahal outlier on the eastern coast of India was studied by Suryanarayana, who has discovered a new species of a *Mesembrioxylon,* coniferous wood.

Cretaceous: (About 125 million years ago). A very small collection from Trichinopoly Cretaceous rocks has been studied by Varma who has published the occurrence of an algal genus, *Clypeina,* discovered for the first time from the Cretaceous formations. This is claimed to be a linking form between the Jurassic and Eocene representative of this genus and has been named *C. Sahnii.*

Tertiary: (About 60 million years ago). Further studies on *Cyclanthodendron Sahnii,* a palm-like plant now found in South America but extinct in India, have been published by Surange as a joint author with the late Professor Sahni. Studies on a palm fruit made by Lakhanapal have been published. He has named the new species as *Nipa Sahnii.* Studies on the algal flora of the lower Eocene beds of Nammal Gorge (Punjab Salt Range) have been conducted by Varma. He has published three new species of *Archaeolithothamnium;* in another publication he described two new species of *Mesophyllum.* He has also recorded a new species of *Lithophyllum.* From the same area Rao and Varma have published a new species of *Solenomeris* and have established its algal nature. In a collection from the Intertrappean beds of C. P., Uttam Prakash has discovered woods belonging to *Euphorbiaceae* and *Anacardiaceae* and also some palms and fruits. A collection from near Pondicherry, S. India, has been studied by Ramanujam who has published a new species of Palmoxylon and two new species of *Mesembrioxylon* and has discovered many dicot woods, including that of Mango also. Lignites from near Pondicherry were studied by Suryanarayana who has reported poor preservation of the microflora. He has also analysed coal samples from Makum Coal-field, Assam with a view to correlate the coal seams and has discovered in these plant fragments of angiospermic nature.

Quarternary: (About 1 million years ago). Lignites and clays from the Quarternary deposits of Kashmir were studied by Dube who discovered spores and pollen in them. He has made some observations regarding the climatic conditions prevailing at that time in the Kashmir Valley.

Recent and present day: A study of the atmospheric pollen of Uttar Pradesh is being done by Nair with a view to study the pollen flora of this Province and to interpret them in terms of pollen production of the present flora and their flight in the air. A collection of pollen and plants of the present flora is being made by Mittre and Nair.

GROUP II. Results of the research work done under the various research schemes conducted at the Institute.

1. *Palaeobotanical investigations in relation to measurement of geologoical age of rocks:* In geology, groups of a certain type of individual come into being at a certain period in the earth's history and then they become extinct. Surprisingly, this phenomenon of extinction of individuals and groups has been found almost universally widespread· This fact has lead to the discovery of certain index fossils, i. e., these fossils indicate a particular age of the rocks for their distribution on the land, thus making it possible for the palaeobotanist to separate rocks of different ages or the land and water surface which was not contiguous with that type of life-conditions. Based on this principle this scheme tries to fix the age of rocks of disputed Ages in India as accurately as possible. One such attempt to fix the age of the Vindhyan rocks of India has already been published under this scheme by Dr. R. V. Sitholey and his co-workers. A preliminary investigation has been carried out on various horizons from Simula Subathu area; Darjeeling and Kashmir Gondwanes. The Infra-Korls have yielded some organic remains which indicate its age as Permo-Carboniferous.

2. *Scheme on the palaeobotanical investigations of Indian coals:* In this scheme is being studied microfossils of coal seams in India, on the basis of which attempts will be made to correlate various coal seams. Millions of years have passed since these coal seams were formed and during this period there have been many upheavals in the earth which have caused disturbances in the coal seams. As a result, the coal seam may get broken from their main mass and may be shifted downwards, upwards or laterally. If a coal field has suffered enormous disturbance and for a number of times the directions in which a particular seam was running changes several times and differently at different places thus, presenting a very complex pattern for the geologist. Here the fossil contents can be of great help to the geologist in tracing out the relationships between different masses of coal seams· This sort of correlation of different seams often helps to discover the untraced coal seams in that area. These studies can also point out the fuel value of different coals. One such analysis of some coal samples from different seams has been published by Dr. K. R. Surange and his co-workers, wherein they have been able to indicate the relationships and differences between certain coal seams in West Bakare coal fields.

3. *Research Scheme on Palynology:* This scheme has been taken up very recently and the work has just been started. Under this scheme it is aimed to build a plant and pollen herbarium and to study the fossil and recent spores and pollen grains. These studies would form a basis for indentification of the fossil spores and pollen grains, whereby a correct information regarding the affinities of the fossil spores and pollen would be possible. So far about 200 pollen slides, along wlth a collection of 350 plants has been made. Besides this, a study of the atmospheric pollen of the Uttar Pradesh is also in progress. A research worker in this scheme has devised a pollen catcher and a motor-driven electric blower which would facilitate work in the study of atmospheric pollen. The pollen work which is being done at the Institute would be of value in taxonomical studies of the flora, interpretation of the pollen in the recent sedimentary deposits, studies of the evolution of pollen aud phylogeny of modern plants, studies of hay fever (which is caused by certain types of pollen to which different people are susceptible), studies of climatology, ecology, and plant geography, etc. Pollen studies could also be of help to the honey industry and in various archaeological and geological problems.

Gleanings

Chemistry: This department, in collaboration with the workers in the Plant Physiology department, is developing the technique of using radioactive tracers like C^{14} and P^{32} for following plant metabolic processes, including photosynthesis. For this purpose paper chromatography and autoradiography techniques are also being employed. With the completion of the cold room, of the electrophoresis apparatus and the equipment of the low temperature laboratory with apparatus like refrigerating and other types of centrifuges, Warburg's apparatus and other apparatus, this laboratory will be equipped for the isolation of particulate bodies like virus, mitochondria, microsomes etc; and for the study of their biochemical behaviour, as well as of enzymes which occur in higher plants and in microorganisms.

Plant Physiology: The algae *Chlorella* and *Scenedesmus*, which have been used mainly for photosynthetic studies in the U. S. A. and other countries, have been collected and their photosynthetic activities under various environmental conditions studied. The feasibility of using photosynthetic products of different kinds of algae as a food substitute is being investigated in U. S. A. and Japan. For tropical countries a type of alga is required which can remain active at higher temperatures of the tropical countries, and whose chlorophyll content is comparatively low so that they can fully utilize the absorbed sunlight for photosynthesis.

J. C. Bose's active substance: Recent investigations with highly metabolising animal tissues like liver, kidney, heart, and skeletal muscles have established the occurrence in them of particulate bodies identified as mitochondria, whose density of occurrence is proportional to the activity of the organ. Staining investigations on thin sections of contractile plant pulvini have shown that in them mitochondria bodies also occur in proportion to their contractile activity, being the highest in the main pulvinus of *M. pudica* and lowest in the inactive pulvinus of *Phaseolus*. These bodies are not identical with J. C. Bose active substance whose nature is still under investigation.

Cytogenetics: The Institute has been carrying out investigations on the production of mutants in economic plants by X-ray irradiation of seeds and by selecting out of the mutants those with desirable economic properties. By irradiation of Jute variety (*Corchorus olitorius*) var. R. 26, new strain named Tall Mutant with several desirable economic properties has been evolved, which has remained stable up to seven generations.

Irradiation experiments have been started since 1950 on *Sesamum* (Til) and *Brassica* (Mustard). In some irradiated Bengal Types of *Sesamum* e. g. No. 12 and No. 16 substantial increase in yield of fruits and in weight of seeds have been observed upto the third generation. The yield of oil, their chemical composition are being studied. Similar significant increases in yield are observed with some strains of *Brassica* (Mustard), but they are still in the early stage of selection.

This year a new mutagenic agent, the β-ray active P^{32}, in the form of sodium dihydrogen phosphate solution, has been used to soak the jute seeds. Phosphorus salts are selectively absorbed in the plant nuclei and the *in situ.* β-irradiation from P^{32} is a very effective mutagenic agent. Out of the plants raised from such treated seeds of R26, a few have shown the characteristics of the Tall Mutant, while some are entirely green, having the character of another *Olitorius* var. *Chinsura green.*

It is a curious fact that during the past nine years irradiation of R26 with X-rays, not a single green mutant was obtained. This year the experiments are being repeating (i) with seeds obtained from the P^{32} mutants and (ii) freshly treated seeds. The group (i) are showing the morphological characteristics of their parents and in (ii) amongst other results from a treated tall mutant a Chinsura green plant has come out. It appears that red coloration probably arises from a single gene mutation which also affects other properties of the jute plant. The relation between gene mutation and anthocyanin coloration have been previously studied in England and other countries in plants like primroses and sweet peas. A similar line of investigation will be started soon in collaboration with the Chemistry Department.

[The Report of the Bose Institute 1953-54 P 6-8]

Trace Elements in Soils: The Division of Plant Industry of the Commonwealth Scientific and Industrial Research Organisation is continuing research in many parts of Australia into deficiencies of trace elements in soils. Similar research is being carried out on trace element nutrition of animals. The results of research so far completed suggest that an undeveloped country can be vastly improved wherever the rainfall is sufficient and where the country is not steep and inaccessible. According to the research workers, there are millions of acres in Australia where one or more of the trace elements must be used to bring the undeveloped country into production.

In his presidential address to the Australian Institute of Agricultural Science, Dr. J. Griffiths Davies said that of the total area of Australia, approximately one-third, or 600,000,000 acres, consisted of relatively well-watered land and about 155,000,000 acres of this was at present undeveloped. Assuming that half of the remainder could not be improved because of difficult topographical features, urban use, etc., Australia was left with an area of 220,000,000 acres capable of improvement. The C. S. I. R. O. believes that trace elements will play an important part in this development.

Sawdust as Mulch: Australian fruit-growers are using sawdust as mulch for apple trees with successful results. An orchard in the Camden district, near Sydney, was treated wita sawdust last September, and the crop this year was good. The district fruit officer at Camden, Mr. J. V. McGrath, stated that a dressing of sulphate of ammonia had been applied at the same time as the sawdust, at the rate of half a ton per acre. The mulched trees showed no ill-effects from the dry conditions that prevailed during part of the summer in the district, while trees on adjoining properties which were unmulched, were adversely affected by lack of soil moisture.

Fruits from the mulched trees were considerably larger and better coloured than those from adjoining areas, and the trees themselves maintained a much better and healthier appearance throughout the season. At the end they carried more and stronger lateral and leader growth than the unmulched trees. In northern New South Wales some banana growers have also experimented with sawdust with good effect. Banana-growing is increasing in that area. The total area under bananas in New South Wales this year is 30,144 acres, the highest on record. Previous highest acreage was 30,144 acres in 1948. During the past two years 756 new growers have entered the industry, making the total now 4,987. Of the total acreage, 26,000 acres are in bearing this year and organisers are getting growers together to meet any marketing problems that may arise.

Urea as a Nitrogen Fertiliser for Potatoes: A potato-grower of Echunga district, South Australia, reports an apparent response from the application of

urea in irrigation water for his potato crop. The urea was applied just after flowering and during the formation of tubers. He dissolved 56 lb. of urea in 44 gallons of water and fed it into the intake side of a pump during the last 20 minutes of a sprinkler run over one acre. This acre of land yield 495 lb. of table potatoes as against 431 lb. from a similar area without urea. The total yield from the treated acre was 14·6 tons as against 12·7 tons with out wera. The results showed a 15 per cent. increase in marketable potatoes, 26 per cent. increase in oversize tubers, and a 35 per cent. decrease in small tubers.

Weather Review — For January, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	1·3	— 0·1	1·3	South	Madurai	1·2	+ 0·4	1·2
	Tirurkuppam*	1·3	— 0·3	1·3		Pamban	0·6	— 2·0	0·6
	Vellore	0·8	— 0·7	0·8		Koilpatti*	0·7	— 0·6	0·7
	Gudiyatham*	0·6	— 0·1	0·6		Palayamcottai	3·0	+ 1·3	3·0
						Ambasamudram*	3·2	— 0·3	3·2
East Coast	Palur*	1·1	— 1·3	1·1	West Coast	Trivandrum	0·8	J. N.	0·8
	Tindivanam*	1·6	+ 0·1	1·6		Fort Cochin	Nil	— 0·9	Nil
	Cuddalore	0·7	— 1·7	0·7		Pattambi*	0·2	— 0·1	0·2
	Nagapattinam	2·6	— 0·1	2·6		Kozhikode	Nil	— 0·2	Nil
	Aduthurai*	2·1	+ 0·3	2·1		Taliparamba*	Nil	— 0·2	Nil
	Pattukottai*	2·6	+ 0·4	2·6		Wynaad*	Nil	— 0·3	Nil
						Nileshwar*	Nil	— 0·2	Nil
						Pilicode*	Nil	— 0·3	Nil
Central	Salem	0·3	J. N.	0·3		Mangalore	Nil	— 0·3	Nil
	Coimbatore (A. M. O.)*	0·1	— 0·5	0·1		Kankanady*	Nil	— 0·1	Nil
	Coimbatore	Tr.	— 0·6	Tr.	Hills	Kodaikanal	1·9	— 1·3	1·9
	Tiruchirapalli	0·5	— 0·3	0·5		Coonoor*	2·6	— 1·7	2·6
						Ootacamund*	0·3	— 0·6	0·3
						Nanjanad*	0·2	— 0·5	0·2

Note :— * Meteorological Stations of the Madras Agric. Dept.
Tr = Trace (0·01" to 0·04")
J. N. = Just Normal.

The weather was practically dry in the first seven days of the month. In the subsequent two days, mild scattered showers occurred in a few places in south Tamilnad. On 10—1—1956 the weather was again dry practically throughout the Madras State. Then on 11—1—1956 localised showers were received in Travancore-Cochin and at a few places in south Tamilnad. On the next day showers were fairly widespread in Travancore-Cochin and somewhat localised in Tamilnad. Localised thunder-showers were recorded in Tamilnad on 13—1—19 6. From 14—1—1956 to 25—1—1956, both days inclusive, the weather was mainly dry in all the districts in Madras State. But during this period a number of mild western disturbances were noticed with no conspicuous change in the weather conditions of the Madras State. On 26—1—1956 showers occurred at a few places in Tamilnad. The weather on the next day was dry. Again on 28—1—1956 light showers were received in a few places in Tamilnad. This sort of receipt of mild scattered showers, at times of a highly localised nature, in Tamilnad and Malabar and South Kanara continued during the remaining three days of the month.

Considering the month of January, 1956 as a whole, practically the rains received happened to be sub-normal in the majority of the districts.

The noteworthy rainfalls and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
12/1/56	Palayamcottai	1·5	North	1·0	— 0·3	Below normal
13/1/56	Nagapattinam	1·5	East Coast	1·8	— 0·4	do.
29/1/56	Madras (Nungampakkam)	2·0	Central	3·1	— 1·6	Far below normal
29/1/56	Madras (Meenambakkam)	2·0	South	1·7	— 0·2	Below normal
30/1/56	Kallakurichi	1·0	West Coast	0·1	— 0·3	Far below normal
30/1/56	Palghat	1·0	Hills	1·3	— 1·0	Below normal

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 9—2—1956.

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service — Postings and Transfers

Name and present post	Posted as
Krishnaswami, P. N., Assistant Cotton Extension Officer, Madurai,	Assistant Cotton Specialist, Tirupur
Neelakantan, L., Assistant Cotton Specialist, Koilpatti,	Assistant Cotton Specialist, Srivilliputhoor
Narayanan, K. T., Agricultural Engineering Supervisor, Coimbatore,	Assistant Agricultural Engineer, (Research), Coimbatore
Raghavan, A., Assistant Cotton Specialist, Tirupur,	Assistant Cotton Extension Officer, Madurai
Santhanam, V., Assistant Cotton Specialist, Coimbatore,	Assistant Cotton Specialist, Koilpatti
Sankaranarayana Reddy, N., Assistant Agricultural Engineer, (Research), Coimbatore,	Assistant Agricultural Engineer, Soil Conservation Scheme, Vellore

Upper Subordinates

Name and present post	Posted as
Doraiswami, G., P. A. to D. A. O., Coimbatore,	Extension Officer, Kangayam
Ganapathy, N. K., A. D., Uthiramerur,	Extension Officer, Tiruvannamalai
Koyammu, K., Oil Seed Assistant, Pilicode,	Coconut Assistant, Chowghat
Kumaran, V., Soil Conservation Assistant, Kangayam,	A. D., Badagara
Krishnaswami Sarma, M. C., A. D., Natham,	Coconut Nursery Assistant, Muthupet
Krishnamurthy, P. S., A. D., Vegetable Seed Stores, Madras,	A. D., Poonamalee
Malathi, M., Botany Assistant, Coimbatore,	Assistant in Plant Physiology, Coimbatore
Masilamani, S., Conservation Assistant, Satyamangalam,	Special A. D., Ootacamund
Mohamed Ibrahim, P. A., Oil Seed Assistant, Nileshwar. II.	Oil Seed Assistant, Pilicode
Mohamed Sultan Mohideen, A. D., Poonamallee,	A. D., Kavaraipettai
Mohamed G. Fathauddin, A. D,, Kavaraipettai,	A. D., Vegetable Seed Stores, Madras
Natarajan, T. E., Tiruvettipuram,	Chemistry Assistant, Palur
Nalla Gounder, S. C., Trainee in Soil Conservation, Ootacamund,	Soil Conservation Assistant, Kangayam
Narayanan Nambiar, P. K., A. D., Tirumalavadi,	Coconut Nursery Assistant, Adirampatnam
Ummerkutty, O. V., Coconut Nursery Assistant, Nileshwar,	Coconut Assistant, Badagara
Pattabhiraman, R., Extension Officer, Kangayam,	A. D., Peravurni
Pinagapany, N., P. P. A., Cuddalore,	A. D., Cuddalore
Palaswami, K. K., A. D., Devakottai,	Extension Officer in Agriculture, Devakottai
Ramasubhu, G., A. D., Vilathikulam,	A. D., Abiramam
Rangaswami, S., A. D., Tiruvadanai,	Extension Officer in Agricultural, Tiruvadanai
Raman, N. V., Special A. D., Ariyalur,	Breeding Assistant, Vegetables, Coimbatore
Ramakrishnan, C., Breeding Assistant, Vegetables, Coimbatore,	Chemistry Assistant, Coimbatore
Ramanarayana Menon, Analyst, Coimbatore,	Coconut Nursery Assistant, Tikkotti
Samuel Joshua Moses, A. D., Sivaganga,	Extension Officer in Agriculture, Kalayarkoil
Sivasubramaniam, T., Trainee in Soil Conservation, Ootacamund,	F. M., C. F., Coimbatore

Name and present post	Posted as
Subramaniam, M., Trainee in Soil Conservation, Ootacamund,	A. D., Dharmapuri
Shanmughavelu, K. A., Extension Officer, Tiruvannamalai,	A. D., Uthiramerur
Thomas, N. K., P. A., to D. A. O., on leave,	P. P. A., Entomology, Tellicherry
Thiyagarajan, N. M., Assistant in Plant Physiology, Coimbatore,	Chemistry Assistant, Coimbatore
Thiruvenkataswami, K. R., Trainee in Soil Conservation, Ootacamund,	Soil Conservation Assistant, Ootacamund
Venkataraman, N., Assistant, Winter Cambodia Scheme, Coimbatore,	Cotton Assistant, Aduthurai
Venkataswami, B., A. D., Cuddalore,	P. P. A., Entomology, Cuddalore
Viswanatha Shetty, B., Research Student,	Assistant in Millets, Coimbatore
Vedachalam, C. D., Trainee in Soil Conservation, Ootacamund,	Soil Conservation Assistant, Satyamangalam

FIELDMEN ASSOCIATION, MADRAS AGRICULTURAL DEPARTMENT,

LAWLEY ROAD P. O., COIMBATORE.

The Thirtieth Annual General Body Meeting for the year 1955 of the Fieldmen Association, Madras Agricultural Department, Lawley Road P. O., Coimbatore held on 4-2-1956 under the Presidentship of Sri V. Narayanan in the Freeman Hall of the Agricultural College and Research Institute, Lawley Road Post.

The following resolution was passed:

"It was resolved to submit necessary representations to the authorities regarding the service conditions of the Fieldmen cadre and for the regularisation of the emergency candidates now faced with discharge".

Office bearers for the year 1956:-

President: Sri M. Saravanabhavandam, Secretary: A. Adiapatham, Asst. Secretary: N. R. Ramamoorthi, Committee Members: C. R. Venkataramanan, A. V. Krishnaswamy, S. Amirthalingam, P. K. Ponnuswamy, Navarathanam, Balagangadaran, K. Ramachandran, Balakrishnan and M. Ranganathan.

DISTRICTS
S. ARCOT ; COIMBATORE
MALABAR, S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of the Activities of the Market Committees during January 1956

I–1: Of the seven Market Committees in the State, only five in the districts of North Arcot, South Arcot, Coimbatore, Malabar and South Kanara continued to function actively, during the month. The activities in the other two Market Committees are just now commencing.

1–2: The following progress was made by the Market Committees during the month in the matter of issue of licences under Madras Commercial Crops Markets Act.

	Section 5(1)		Section 5(3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee ..	173	173	144	144	62	62	—	—
South Arcot Market Committee ..	434	434	410	410	381	381	—	—
Coimbatore Market Committee ..	57	57	85	85	92	92	3	3
Malabar Market Committee ..	137	137	432	432	109	109	4	4
South Kanara Market Committee ..	86	86	77	77	34	34	—	—
Ramanathapuram Market Committee ..	2	2	3	3	—	—	—	—
Tirunelveli Market Committee ..	1	1	1	1	—	—	—	—

A: During the Month. B: Up to the end of the month from January, 1956.

1–3: The total volume of transactions in commercial crops in 14 Regulated Markets in the State during January 1956, is extracted below.

Crop		Quantity	No. of Regulated Markets
Groundnut Kernels	..	6,580 Tons	10
Gingelly	..	71 Tons	3
Cotton Kapas	..	470 Pothis	2
Cotton lint	..	Nil	—
Coconut	..	Nil	—
Arecanut	..	Nil	—
Tobacco	..	Nil	—

II. **Meetings:** 2–1: The first meeting of the Coimbatore Market Committee during 1956 was held in the office of the Committee at Tirupur. Sixteen subjects were discussed at the meeting. The following are a few important subjects discussed.

(a) Raising the minimum quantity from 20 maunds to 60 maunds allowed as a concession to petty dealers of Tobacco as per by-law 21(i)b and 21(2) (b)

(b) Resolved to replace the word "fee" in the By-laws by the word "cess".

(c) Approval of the budget estimates of the Committee for 1956.

2–2: No meetings were held in other Market Committees.

III. **Quality Appraisal:** 3–1: The South Arcot Market Committee continued its work on the quality analysis of Groundnut Kernels marketed in that district. A total of 257 samples were drawn and analysed during the month from out of 4,057 lots comprising of 44,356 bags of Kernels. The details of analysis, which may be of interest are extracted below:—

Particulars		Cuddalore	Villupuram	Virudhachalam	Panruti
1. *Dryage:*					
2% and below	..	8	4	44	2
Above 2% and upto 3%	..	12	4	11	5
Above 3% and upto 4%	..	18	3	4	7
Above 4% and upto 5%	..	27	4	1	1
Above 5% and upto 10%	..	33	6	—	27
Above 10%	..	8	3	—	19
2. *Total Refraction:*					
4% and below	..	8	10	19	65
Above 4% and upto 8%	..	55	11	41	—
Above 8%	..	43	3	—	2

The total common refraction was below 4% in 102 samples, 5 to 8% in 107 samples and above 8% in 48 samples.

3-2: During the month 76 entrants were enlisted for the Winter Crop Quality Competition in South Arcot District.

State Marketing Officer.

Quality Analysis of Winter Groundnuts of 1954—'55 Marketed in South Arcot District.—Objective Study conducted by South Arcot Market Committee, Cuddalore

by

SRI K. V. NATESAN, B. Sc. (Ag.,)
(Secretary, South Arcot Market Committee, Cuddalore)

The objective study of the quality of groundnuts marketed in South Arcot District started from the 1954 summer crop season in five markets of this Committee, was continued in the winter crop (rainfed crop) season also.

Review of Summer Crop: The total arrivals of groundnut kernels marketed in all the five markets during the summer crop season, where the analysis was done, amounted to 3,96,076 bags. 3,245 samples were drawn from 12,526 bags at random and analysed for moisture, foreign matter and other detracting elements like blacks, splits, brokens, nooks and shrivelled nuts etc. Studies made in respect of variety such as "Spreading" or "Bunch" revealed that 98% of the quantity marketed were all of the spreading type and only 2% of the "bunch type". Methods adopted in decorticating the groundnut pods were also studied with an idea to see how far machine decortication is adopted by ryots. This revealed that hand-beating the produce with sticks after moistening the pods is still continued on a large scale and 53·5% of the produce marketed were of the hand-beaten stuff only. Machine-shelled groundnuts represented only 45·9% of the total produce marketed. Besides this, the size of groundnut holdings of individual ryots whose lots were analysed and the interval between the time of harvest and marketing of the crop were also studied. From the analysis of the processing details, it was revealed that of all the markets,

Vridhachalam had the lowest percentage of foreign matter and other detracting components with minimum moisture in the samples as against other markets. At Cuddalore and Villupuram the samples analysed showed high percentage of both 'moisture' and 'refraction'. Tindivanam stuff contained a high percentage of refraction with low percentage of moisture, while Tirukoilur stuff contained high percentage of moisture with low percentage of foreign matter and other detracting elements. The time lag between harvest and marketing was very short in the majority of the cases and within two weeks after harvest 78% of the total produce got marketed, and 20% between two weeks and two months from harvest and the balance of 2% any time later than two months. The poor economic condition of the ryots of this district in general coupled with the lack of staying power in holding back their harvested produce for a reasonable period, due to want of facilities for storing and the pressing need for money, have all been responsible for the rush of produce to the markets soon after harvest.

Observations on Winter Crop: The following observations are made in respect of quality analysis conducted during the winter crop season of 1954—'55 in the markets mentioned above. Total arrivals of winter crop from November 1954 to March 1955 amounted to 2,70,816 bags in the above five markets. 2,573 samples were analysed and quality factors determined as in the summer crop season. Hand-beating with sticks of the pods has been the vogue in the market areas of Vridhachalam, Villupuram and Cuddalore. 92·2% of the samples, representing a quantity of 1980 bags at Vridhachalam, 77% of the lots representing a quantity of 1210 bags at Villupuram and 64·6% representing a quantity of 1505 at Cuddalore were hand-beaten. Machine-shelling has been more popular among ryots in the market areas of Tirukoilur and Tindivanam, only, where 67% of the samples representing a quantity of 760 bags and 79% of the samples representing a quantity of 1229 bags were machine-decorticated.

Taken as a whole it was found that machine decortication was only 44·7% in the rainfed crop season against 45·9% in the summer crop season. Hand-beaten produce was 55% against 53·5% in summer. A comparative statement showing the different percentages is appended in annexure I.

The ordinary spreading variety (Local Mauritius) is the crop grown in usually in the District. Bunch variety is grown only in the market areas of Tindivanam and Vridhachalam.

STATEMENT I

Name of the Market	Lots	Quantity of arrivals of winter crop in bags	Samples analysed		Samples of spreading variety		Samples of bunch variety		Samples of machine shelled		Samples hand-beaten		Samples hand picked		Average dryage percent	Average refraction reduced to common per cent basis
			No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.		
Tindivanam	18,578	74,313	303	1,329	303	1,329	..	..	240	1,229	63	100	..	..	3·5	10·1
Cuddalore	5026	21,905	600	2,509	593	2,499	7	10	202	984	388	1,505	10	10	4·9	5·1
Vridhachalam	25,678	92,035	752	2,157	752	2,157	..	..	59	177	693	1,980	..	..	4·2	2·7
Villupuram	7,564	30,256	516	2,282	516	2,282	..	..	119	1,072	397	1,210	..	..	8·5	3·9
Tirukoilur	17,435	52,307	402	1,161	402	1,161	..	..	260	760	142	401	..	..	6·0	5·0
Total	74,281	2,70,816	2,573	9,438	2,566	9,428	7	10	880	4,222	1,683	5,196	10	10		
Percentage			3·4%	3·4%	99·7%	99·8%	0·27%	0·1%	34·2%	44·7%	65·4%	53%	0·4%	0·1%		

Note: Quantity in all the columns denote bags of 177 lb. net kernels.

STATEMENT II

Moisture variation

Name of the Market	Samples analysed		Samples in which moisture is below 1%		Moisture is upto 2% but above 1%		Moisture is above 2% but below 4%		Moisture is above 4% but below 8%		Moisture is above 8% but below 10%		Moisture is above 10% but below 15%		Moisture is above 15%	
	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.
Tindivanam	303	1329	12	50	93	264	164	682	23	284	7	36	4	13	..	..
Cuddalore	600	2509	2	35	18	65	254	549	223	1480	68	253	35	127	..	..
Vridhachalam	752	2157	155*	324	238	961	329	775	12	48	8	24	10	25	..	..
Villupuram	516	2282	..	..	..	..	65	167	205	1346	166	598	80	171	..	..
Tirukoilur	402	1161	1	1	52	173	207	351	68	415	41	164	33	57	..	..
Total	2573	9438	170	410	401	1463	1019	2524	531	3573	290	1075	162	393		
Percentage		100	6·6%	4·3%	15·6%	15·6%	39·8%	26·7%	20·6%	37·8%	11·2%	11·4%	6·2%	4·1%		

* Of this sixty lots are "pucca." Pucca means fully dried produce fit for crushing in the expeller.

Statement No. II. The average percentage of moisture in groundnuts varied from 3 to 8%. It was 3·5% at Tindivanam, 4·2% at Vridhachalam, 4·9% at Cuddalore, 6% at Tirukoilur and 8·5% at Villupuram.

Vridhachalam and Tindivanam accounted for 52·3%, (1285 bags) and 34·6% containing a quantity of 314 bags analysed for moisture between 0 and 2%. From a comparative study between the markets and the summer crop it was found that the produce received at Tindivanam and Vridhachalam contained 3·5% and 4·2% of moisture only, whereas the produce of Villupuram market contained 8·50% moisture on the average. This is due to the fact that the pods are over-moistened for hand-beating the stuff with sticks and the kernels after decortication are not dried before sale.

Presence of Foreign matter: Taken as a whole 56·9% of the total number of samples of all the markets viz., 1464 samples showed foreign matter below 1%, while 39·3% contained foreign matter below 4% and above 1%, and 3·4% of the samples showed foreign matter between 4% and 8%. Individually high percentage of foreign matter was visible at Tirukoilur and Villupuram whereas samples from Vridhachalam showed minimum foreign matter.

Nuts in Shell: All the samples analysed contained nuts in shell within 10% range. Nuts in shell were more common in samples which were subjected to machine decortication than in samples which were hand-beaten.

Damaged kernels: High percentage of damaged kernels was visible in the samples analysed in the four markets of Cuddalore, Villupuram, Tirukoilur and Tindivanam while it was at its minimum at Vridhachalam market in which 79% of the total samples viz. 594 lots consisting of 1671 bags contained damaged kernels within 2% range only. At Tirukoilur, Tindivanam, Cuddalore and Villupuram the percentage of damaged kernels within 2% range was visible in 39·8%, 35%, 28·5% and 9·8% of the samples. At Cuddalore it ranged between 4% and % in 175 samples, at Tindivanam in 86 lots, at Tirukoilur in 142 lots and at Villupuram in 175 lots, while at Vridhachalam it was visible only in 51 lots. Damaged kernels above 10%, was visible at Cuddalore and Villupuram in 135 lots consisting of 814 bags at the former at 156 lots consisting of 569 bags at the latter.

STATEMENT NO. III.

Refraction and other deleterious contents.

Market	Foreign matter such as stones and dust			Nuts in Shell		Damaged Seeds				Splits		Brokens		Nooks			Shrivelled		Total Number of Samples
	4 and below	Above 4% upto 8%	Above 8%	10% and below	Above 10%	2% and below	Above 2% but below 4%	Above 4% but below 10%	Above 10%	25% and below	Above 25%	10% and below	Above 10%	5% and below	Above 5% but below 10%	Above 10%	2% and below	Above 2%	
Tindivanam																			303
No. of Samples	286	12	5	300	3	106	65	86	46	249	54	287	16	303	..	..	303	..	
Quantity	1274	49	6	1303	26	424	285	361	259	942	397	1254	75	1329	..	..	1329	..	
Cuddalore																			600
No. of Samples	591	9	..	599	1	171	119	175	135	552	48	597	3	475	113	12	192	408	
Quantity	2457	52	..	2509	..	583	281	831	814	2218	291	2497	12	2119	350	40	521	1988	
Vridhachalam																			752
No. of Samples	752	..	..	752	..	594	72	51	35	752	..	750	2	637	98	17	164	588	
Quantity	2157	..	..	2157	..	1671	216	170	100	2157	..	2145	12	1808	311	38	533	1624	
Villupuram																			516
No. of Samples	481	35	..	516	..	51	134	175	156	516	..	516	..	484	20	12	..	516	
Quantity	2009	273	..	2282	..	416	377	920	569	2282	..	2282	..	1750	459	73	..	2282	
Tirukoilur																			402
No. of Samples	370	32	..	402	..	160	38	142	62	397	5	347	55	390	12	..	326	76	
Quantity	1051	110	..	1161	..	195	208	519	239	1161	..	1098	63	1131	30	..	929	232	

STATEMENT IV

Size of Holdings

Name of the Market	Samples 1 Acre and below		Above 1 acre but below 2 acres		Above 2 acres but below 3 acres		Above 3 acres but below 4 acres		Above 4 acres but below 5 acres		5 to 10 acres		Above 10 acres		
	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	No.	Qty.	
Tindivanam	81	97	63	218	79	296	12	197	20	103	40	327	8	91	
Cuddalore	183	404	139	762	63	317	52	513	18	375	44	101	11	36	
Vridhachalam	501	652	155	989	43	299	21	96	19	28	13	93	..	..	
Villupuram	160	391	164	458	63	231	39	242	37	177	48	689	5	...	
Tirukoilur	222	260	98	117	32	279	37	153	8	71	5	81	..	..	Total
	1147		619		280		161		102		150		24		2483
Percentage	47%		24·8%		11·2%		6·3%		4·1%		5·9%		0·9%		

Splits and Brokens: Splits and brokens were large in places where machine decortication is popular, eg. at Tindivanam and Tirukoilur. In the majority of samples in other markets the percentage of splits and brokens were at their minimum as could be seen from the Statement III.

Nooks: The presence of nooks in the majority of samples was within 5% range. However, a high percentage ranging between 5 and 10% was visible at Virdhachalam and Cuddalore. This is perhaps due to beating the pods with sticks.

Shrivelled Kernels: High percentage of shrivelled kernels was noticed at Tindivanam, Villupuram and Cuddalore while it was low at Vridhachalam and Tirukoilur. Harvesting of immature pods due to want of sufficient rains at the growing period is the chief cause for such high percentages.

STATEMENT V.

VARIATIONS IN HARVESTING

Months in which the crop is harvested, with number of samples in each.

Name of Market		November	December	January	February
Tindivanam	..	161	117	23	2
Cuddalore	..	260	103	64	87
Tirukoilur	..	120	210	40	..
Vridhachalam	..	127	625	..	..
Villupuram	..	25	150	24	21
Total	..	693	1,205	151	110
					Total 2,159
Percentage	..	32·1%	55·3%	7%	0·6%

STATEKENT VI.

Interval Between Harvesting and Marketing

Name of Market		Within one week of harvest	Between one week and two weeks	Between 2 and 4 weeks	One month and more after harvest
Tindivanam	..	8	28	24	243
Cuddalore	..	42	161	148	159
Tirukoilur	..	180	130	55	5
Vridhachalam	..	..	27	105	620
Villupuram	..	82	64	48	230
Total	..	212	410	380	1,257
					Total 2,259
Percentage	..	9·0%	18%	21%	52%

General: As in the case of summer crop the quality of kernels was above average at Vridhachalam in respect of moisture and refraction and good in respect of moisture alone at Tindivanam. In other markets the quality was below average and the incidence of moisture and refraction was fairly high. Even though ryots as a class in South Arcot District are poor as could be seen from the size of their holdings, they have been told very many times that by marketing wet and inferior stuff they will only lose heavily in their income, yet they bring only wet stuff with 2% to 8% moisture. Even educated ryots bring such bad stuff. Not that they

Comparative Statement of Quality Analysis of Groundnuts 1954—1955

	Details	Summer Crop 1954			Winter Crop 1954—1955		
1.	Total Arrivals to the Markets where analysis was done ..	3,96,076 Bags			2,70,816 Bags		
2.	Number of Samples analysed ..	3,245 Samples comprising 12,526 bags			2,566 Samples		
		Spreading	Bunch		Spreading	Bunch	
3.	Variety ..	98%	2%		99·7%	0·3%	
4.	Decoration:						
	Machine-Shelled ..	45·9%			34·2%		
	Hand-Beaten ..	53·5%			65·7%		
	Hand-Shelled ..	0·6%			0·17%		
	Hand-beaten:						
	Vridhachalam ..	88·8%			92·2%		
	Cuddalore O. T. ..	70·0%			64·6%		
	Tindivanam ..	40·0%			21·0%		
	Villupuram ..	40·0%			77·0%		
	Tirukoilur ..	20·0%			33·0%		
5.	Variations in size of holdings ..	They are mostly within one acre range			They are within one to two-acre range		
		Early.	Mid-season.	Late.	Early.	Mid-season.	Late.
6.	Harvesting Period:	May	June Aug.	Sep.	Oct. Nov.	Dec.	Jan. Feb.
7.	Percentage of harvests in each of the seasons ..	30%	50%	20%	32·1%	55·3%	7·6%
8.	Arrivals to the markets after ..	78% within 2 weeks 20% within 2 months 2% later			27% One month 21% After one month 52%		
9.	Moisture Variations:						
	Below 1% ..	3.42%			6·6%		
	Between 1—2% ..	10·84%			15·6%		
	Between 2—4% ..	27·70%			39·6%		
	,, 4—6% ..	27·70%			—		
	,, 6—8% ..	6·8%			20·6%		
	,, 8—10% ..	7·80%			11·2%		
	Above 10% ..	5·10%			6·2%		
10.	Average Dryage:						
	Cuddalore ..	5·66%			4·5%		
	Tindivanam ..	3·86%			3·5%		
	Tirukoilur ..	6·98%			6·0%		
	Villupuram ..	6·32%			8·5%		
	Vridhachalam ..	3·30%			4·2%		
11.	Total Refraction reduced to common basis:						
	Cuddalore ..	10·07			5·1%		
	Tindivanam ..	8·51			10·1%		
	Tirukoilur ..	3·91			5·0%		
	Villupuram ..	6·35			3·9%		
	Vridhachalam ..	3·07			2·7%		

have not understood that by getting better dried stuff they will get better price, but they probably imagine they can dupe the merchants in this manner.

A scheme for quality competition of groundnuts was submitted to Government and has been sanctioned for the year 1955–'56.

Crop and Trade Reports

Pepper — Second forecast report — 1955 — '56 — Madras State: The area under pepper upto 25th December, 1955 in the districts of Malabar, South Kanara and the Nilgiris is estimated at 123,750 acres (105,000 acres in the Malabar district, 18,600 in South Kanara district and 150 acres in the Nilgiris district). Compared with the acrea of 119,350 acres (101,900 acres in Malabar 17,300 acre in South Kanara and 150 acres in the Nilgiris) estimated for the corresponding period of last year it shows an increase of 3·7 percent. The seasonal factor is estimated at 92 percent of the normal for Malabar district, 98 percent of the normal for South Kanara and the Nilgiris districts as against 92 percent of the normal in Malabar district, 88 percent of the normal in South Kanara district and normal in the Nilgiris district estimated for the corresponding period of last year. On this basis the total yield is estimated at 9,700 tons (8,150 tons in Malabar district, 1,540 tons in South Kanara district and 10 tons in the Nilgiris district). Compared with the yield of 9,200 tons (7,910 tons in Malabar, 1,280 tons in South Kanara and 10 tons in the Nilgiris) estimated for the corresponding period of last year it shows an increase of 5·4 percent. The wholesale price of pepper per standard maund of 82-2/7 lb. or 3,200 tolas on 6–1–1956 was Rs. 99–15–0 for Nadam and Vatakkan varieties, Rs. 111–11–0 for Wynaad variety at Kozhikode, Rs. 122–10–0 at Tellicherry and Rs. 117–9–0 at Mangalore. Compared with the prices in corresponding period of last year i. e., those which prevailed on 8–1–1955, these prices show a fall of 5·6 percent for Nadan and Vatakkan varieties, 9·5 percent for Wynaad variety at Kozhikode and a rise of 18·1 percent at Tellicherry and 16·2 percent at Mangalore.

Ginger — Second forecast report — 1955 — '56 — Madras State: The area under singer crop upto 25th December, 1955 in the Districts of Madurai, Malabar, South Kanara and the Nilgiris is estimated at 15,200 acres. Compared with the area of 14,880 acres estimated for the corresponding period of the last year it shows an increase of 2·2 percent. Compared with the average area of 13,450 acres for the previous five years ending with 1954–55, the present estimate reveals an increase of 13·0 per cent. A decrease in area is estimated in the districts of Madurai and the Nilgiris and an increase in the district of Malabar. There is no change in the area estimated for South Kanara district. The yield per acre is expected to be normal in the districts of Malabar, South Kanara and the Nilgiris and below normal in Madurai district. On this basis the total yield is estimated at 5,430 tons of dry ginger Compared with the estimated yield of 5,310 tons of dry ginger for the corresponding period of last year it shows an increase of 2·3 per cent. Compared with the average yield of 4,680 tons of dry ginger for the previous five years ending with 1954–55, the present estimate reveals an increase of 16·0 per cent. The wholesale price of dry ginger per standard maund of 82–2/7 lb. or 3,200 tolas at important market centres on 6–1–1956, was Rs. 76–6–0 for Charnad variety Rs. 73–7–0 for ordinary variety at Kozhikode and Rs. 180–0–0 at Mangalore. Compared with the prices for the corresponding period of the last year (i. e. 8–1–1955) these prices show a decrease of 3·7 per cent for charnad variety, 3·8 per cent for ordinary variety at Kozhikode and an increase of 104·3 per cent at Mangalore.

Figures of area and yield by districts are furnished in the statment appended.

Cotton Raw, in the Madras Presidency: The receipts of loose cotton at presses and spinning mils in the Madras Presidency from 1st September 1955 to 13–1–1956 amounted to 61956 bales of 392-lb. The recipts from 1st February 1954 to 14–1–55 of the previous year were 149439 bales. 197578 bales mainly oi pressed cotton were received at spinning mils and 724 bales were exported by sea while 5662 bales were imported by sea mainly from Karachi and Bombay.

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Editorial

The Frontiers of Science: An army on the march consists not only of regular troops with their armaments, but also includes a whole host of auxiliary equipment, not to mention camp followers and hangers-on. A similar analogy holds good in the field of science as well. Right from the days of the Phlogiston theory there has always been a fringe of pseudo-science on the outskirts of genuine scientific work and particularly in recent times, when specialisation has reached such a stage that one is virtually as ignorant as the proverbial man in the street in all fields of knowledge except one's own special field, it is difficult to judge where exactly the dividing line comes, between genuine science and its pseudo counterpart.

Thus, we have in many advertisements of commercial products, fine-sounding names of new and wholly imaginary chemicals, furnished with cunningly-worded claims for their miraculous properties in turning every woman into a Helen of Troy and every man into an Adonis. Then we have the vitalists, a very hardy breed, who keep on harping upon the "proven fact" that crops grown with anything other than "natural or organic manures" are bound to be inferior not only in their vigour and freedom from pests and diseases, but, also in their power of keeping healthy the persons who consume such "unnaturally manured" crops. This view persists even today, in spite of countless experiments to prove the contrary, that crops raised with inorganic nutrients are in no way inferior to those grown with organic manures. Some have even gone to the extent of saying that the increase in the incidence of cancer is due to the increasing use of artificial fertilisers, although here again, the facts point to the opposite view.

Thus Switzerland, which uses only about 14 lb. of potash per acre of arable land has a mortality from cancer, of 173 per 100,000 inhabitants, while Belgium, which uses 744 lb. per acre of potash has a cancer mortality of 117 per 100,000. Another set accuses mineral manuring of merely

raising the yields while the quality of the product is impaired. This of course is merely another form of the "good old times"-notion, that "nothing today is as good as it used to be". The use of fertilisers, it is claimed, makes vegetables "melt away in the saucepan", whereas in actual fact, it is only vegetables that are grown on soils too rich in organic nitrogen, as in sewage farms, that contain hardly anything but cellulose and water and are lacking in flavour and in mineral salts.

Another borderland region between real and pseudo-science is the inheritance of acquired characters which comes into prominence every now and then, from Lamarckianism, through Kammerer's newts down to Lyssenko's conversion of wheat into rye, barley and oats. Lyssenko claimed that if *durum* wheat of the 28-chromosome type, were sown late in autumn, in two or three generations some of these plants were converted in to the 42-chromosomed, soft-wheat, *Triticum vulgare* and this claim was further underlined by the statement that the "abnormally arising grains were confirmed as belonging to *T. vulgare* by sowing the seeds, when soft wheat plants were produced as a rule". A discreet silence is maintained, however, regarding the remaining cases, whether they failed to germinate or produced only *durum* plants. Similarly, various claims are made from time to time about methods of predicting the sex of the progeny in animals and human beings, by swinging an ivory pendulum over the prospective mother and noting whether it swings in a 'straight' or oval fashion. Another interesting claim has been made recently that plants are encouraged to grow better and faster if certain tunes are played near them on certain types of musical instruments, but until such results are found reproducible by independent workers elsewhere in the world, it seems wiser to reserve our judgment on these claims. Science is of course only organised commonsense, but nevertheless it should not get so peculiarly organised as to become a substitute for common sense.

Additional notes on some aphids in the Madras State

by

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Of the seventy species of aphids recorded by the writer (David 1954 a, b, c), sixty-eight are known to occur within the Madras State. Collections made since then include three species which were noted by George (1927) previously. In this paper these species are reviewed as to their present systematic position, distribution and status in economic entomology. For fourteen other aphids which have already been commented upon in previous papers, additional notes are given.

1. *Dactynotus (Uromelan) carthami* HRL. (Syn. *Macrosiphum solidaginis* (Fab) *sec.* George 1927 and Ullah 1940): This aphid is easily recognised by the deep black colour of the nymphs and the apterous and alate forms. Only the distal portion of the femora are yellow. Siphunculi have reticulations on the distal 1/5th of its length. The cauda bears about 18 long and thick hairs.

Measurements in mm.

	Length of body	Antennæ	Siph.	Cau.	Antennal segments III	IV	V	VI
Apteræ	2·85	3·26	·83	·54	·95	·54	·40	·14 + ·97
Alatæ	2·85	3·37	·92	·43	·91	·56	·45	·15 + 1·06

Rhinaria on the III antennal segment in apteræ number 58 to 60 and in alatæ about 100. Length of last rostral segment 0·17 mm.; length of second joint of hind tarsi 0·14 mm.

Host: *Carthamus tinctorius* (Safflower).

Locality: Coimbatore. November to January.

This is one of the largest aphids in South India. It feeds mainly on the stem of the plant but when it gets crowded it feeds on the undersurface of the lower leaves. The colonies are large and are easily detected by their colour though ants are not found attending on them. It has been noted as affecting safflower to a considerable extent in Bellary and Coimbatore (Ayyar 1940). But large numbers of aphids occur on these plants only when they have already flowered and the damage is not severe.

Das (1918) recorded an aphid on *Sonchus* sp. as *Macrosiphum solidaginis* (Fab). Though he was keeping safflower under close observation for studying in detail two other aphids, he did not find his *M. solidaginis* feeding on safflower. It is evident that this is a species which does not feed on *Carthamus.* George (1927) and Ullah (1940) identified their safflower aphids as *M. solidaginis.* But Hille Ris Lambers (1939, 1948) showed that the European form for which this name has to be applied, is a distinct one and described an aphid on *Carthamus glaucus* from Israel as *Uromelan carthami* HRL. The South Indian form is similar to this species but has about twice the number of rhinaria on the third antennal segment in both apteræ and alatæ. Since the variability of this character in the species from Israel is not known, this is tentatively retained in this species.

2. *Greenidea artocarpi* (Westwood): The nymphs of this species are pale green in colour. The apterous form is pale brownish green with black siphunculi which are very long and slightly swelling in the middle. These also bear thick, long hairs of varying length and are covered over with small spinules which mark out a pattern of reticulation on the surface. The caudal process is small, narrow and conical. The alate form is dark green and has oval irregular rhinaria on the third antennal segment. The abdominal segments 2 to 6 have broad transverse seclerotic bands. The last segment of the rostrum is slender and tapering and rostrate with about 13 small hairs in the proximal portion. The apical hairs in the rostrate portion are minute.

Measurements in mm.

	Length of body	Ant.	Siph.	Cau. process	Antennal segments III	IV	V	VI
Apteræ	2·46	2·64	1·31	·06	·74	·31	·39	·28 + ·77
Alatæ	2·06	2·91	1·93	·06	·91	·36	·39	·31 + ·75

Rhinaria on the third antennal segment in alate 38 & 35; length of last rostral segment ·15 and second joint of hind tarsus ·12 mm.

Hosts: *Artocarpus heterophylla* (Syn. *A. integrifolia*) (jack fruit) and *A. incisa* (bread fruit).

Locality: Coimbatore and Kallar (The Nilgiris).

Date: January-February and September-October.

The aphids are found feeding on the under surface of tender leaves [usually on the leaves near the main trunk of the tree. Even a large colony did not cause any visible injury to the leaf or plant. Ants are not found attending on them nor could any predators or parasites be found on them. Previous records of this aphid are from Malabar (George 1927) and Mysore (Krishnamurthy 1930). Though Ayyar (1940) regards it as an important pest of jack, no serious damage by this insect has been brought to the notice of the writer so far.

3. *Acyrthosiphon pisum* (Harris). (Syn. *Macrosiphum pisi* Kalt, *Illinoia pisi* Kalt): The aphid is pale green in all stages with long, slender, tapering siphunculi.

Measurements in mm.

	Length of body	Ant.	Siph.	Cau.	Antennal segments III	IV	V	VI
Apteræ	3·50	3·83	1·00	·33	·86	·68	·68	·26 + 1·04
Alatæ	2·81	3·84	69	·39	·82	·74	·69	·28 + 1·08

Rhinaria on the III antennal segments in alate 15 & 16· Length of last rostral segment ·12 mm. and second joint of hind tarsus ·15 mm.

Host. *Pisum sativum* (Pea).

Locality: Ootacamund (7200 ft. above M. S. L.)

Date: July to September.

This is a familiar, large green aphid found on peas, especially the sweet variety. It occurs sometimes in considerable numbers and causes appreciable damage to the plant. Though it feeds on a number of other plants and is considered to be a pest of clover and lucerne in America, it has not so far been noted on any other plant in this region.

A closely allied form occurs on *Sesbania grandiflora* (Agathi) on the plains. Among the collections at Bangalore it was found that this species was recorded on the same host there also, as well as on linseed. But the aphid collected on peas in this locality was only *A. pisum*.

4. *Aphis craccivora* Koch: In the collections at Bangalore the slides labelled *Aphis rumicis* L on cowpea and *Anuraphis cynariella* Theob. on *Cyamopsis psoralioides* were found to be this species.

Hosts: *Achyranthes aspera* in February; *Indigofera oblongifolia* in June; *Amarantus gangeticus* and *A, viridis* in February; *Erigeron asteroides, Solanum melongena* (brinjal) and *Vernonia cineria* in March.

A severe infestation of this aphid occurred on brinjal and amarantus during February and March 1955. This is an unusual occurrence as this aphid has not been noted to feed on these plants at other times.

5. *Aphis gossypii* Glover.

Hosts: *Cleome chelidonii* and *Emelia sonchifolia* in March. *Ficus banyan, F. tsiela* and *Holoptelia integrifolia* in November, *Prosopis juliflora* and *Stenolobium stans* in March.

6. *Aphis punicae* Pass.

Distribution: Madras, in January.

7. *Hyadaphis coriandri* (Das).

Hosts: *Foeniculum vulgare* and *Cuminum sativum. Carum copticum* in the vicinity was not affected.

8. *Macrosiphum euphorbiæ* (Thomas).

Host: *Echeveria* sp. Locality: Ketti. Date: July and September.

9. *Macrosiphum (Sitobion) avenæ* subsp. *eleusinae (*Theob).

Hosts: *Bothriochloa insculpta, Dactyloctenium aegyptium, Eragrostis superba* and *Cymbopogon martini.*

10. *Macrosiphum (Sitobion) graminis* (Takahashi).

Host: *Chloris barbata.* Locality: Coimbatore. Date: February.

11. *Macrosiphum (Sitobion) lambersi* David.

Hosts: *Ischaemum aristatum,* and *Digitaria marginalis* in March-April and *Eremopogon foveolatus* in November at Coimbatore. *Cynodon dactylon* and *Paspalum conjugatum* at Kallar (The Nilgiris) in November.

12. *Oregma bambusæ* Buckton. Distribution: Coimbatore.

13. *Pentalonia nigronervosa* Coq.

Hosts: *Musa paradisiaca, M. cavendishii, M. superba, M. rosacea* in June. *Calladium* sp., *Elleteria cardamomi* and *Colocasia* sp. in November at Coimbatore.

14. *Rhopalosiphum maidis* (Fitch).

Host: *Cenchrus ciliaris,* and *Panicum antidotale* at Coimbatore.

15. *Tetraneura hirsuta* (Baker).

Host: *Echinochloa colona* in June.

16. *Toxoptera aurantii* (B. d. F.)

Hosts: *Artocarpus heterophylla,* (jack) *A. incisa* (breadfruit), *Santalum album* (sandalwood), *Tamarindus indicus* (tamarind) at Coimbatore.

17. *Toxoptera odinæ* (v. d. Goot).

Hosts: *Hibiscus rosasinensis* (shoe-flower) and *Hamelia patens* at Coimbatore.

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A Note on the Double Cropping of Paddy in Wynad

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In Madras State, Malabar is one of the deficient districts in rice production, even though the total area under paddy in Malabar is fairly high. Malabar records a total production of 3·17 lakhs tons from an area of 8·45 lakhs acres which compares very unfavourably with the production of 8·5 lakhs tons from a cultivated area of 13·38 lakhs acres in Tanjore district. On this basis Tanjore records a mean acre yield of 1400 lb. per acre while in Malabar the average yield works out only to 900 lb. per acre (Natarajan 1941). This situation therefore calls for consideration of the ways and means to augment the production of rice in this district.

Ramiah (1953) has observed that many parts of Orissa which were more or less akin to Wynad, a high - lying taluk of Malabar in respect of terrain and climatic conditions, have made a mark in rice production by adopting the "double cropping" of paddy lands. It was therefore considered possible that the same practice could be applied to parts of Wynad with advantage. One major handicap, however, which confronts the rice grower in Wynad is the prolongation of duration of paddy crops, as a result of which sufficient time is not available for raising a second crop. But with suitable short-duration varieties, there is scope for raising two crops of paddy in this region.

With the object of securing two crops in a year, trials were conducted at the Agricultural Research Station, Ambalavayal (Wynad) to determine the optimum combination of two paddy varieties that could be usefully raised in the double - cropping scheme in wetland blocks which commanded satisfactory irrigation facilities. Several combinations of long and short duration types of paddy previously tested and found promising under Wynad conditions for the first and second crop seasons, were included in this trial. The yields obtained from these combinations are set out as follows:

First Crop				Second Crop					
Name of Variety strain or culture	Duration in days	Yield per acre in lb.	Value in Rs.	Name of Variety or culture	Duration in days	Yield per acre in lb.	Value in Rs.	Total yield in lb.	Value in Rs.
Combination I.	Short duration first crop variety followed by long duration second crop variety.								
Siamese									
type 2801	142	2690	294/-	MTU. 19	218	1397	152/12/-	3997	153/-
do. 2801	142	2554	279/-	Kothandan	202	1727	189/-	4281	468/-
Combination II.	Medium duration first crop variety followed by long duration second crop variety.								
Palthondy									
9114	165	3638	398/-	MTU. 19	218	771	84/-	4409	482/-
do. 9114	165	3710	406/-	Kothandan	202	1519	166/-	5229	572/-
Combination III.	Long duration first crop variety followed by short duration second crop variety.								
MTU. 19	218	3075	330/-	Co. 13	120	1515	166/-	4590	502/-
Kothandan	202	3932	430/-	Palthondi 9114	165	2081	228/-	6013	658/-

It would be observed from the above data that the most profitable combination on considerations of yield was of *Kothandan* 517 in the first crop, followed by *Palthondi* 9114 in the second crop seasons. Growing of short duration varieties in the first crop followed by long duration varieties in the second crop invariably led to low yields. In terms of monetary value, the third combination has yielded an income of Rs. 658/- per acre, as compared to the maximum income of Rs. 430/- realised from a single crop of Kothandan.

These methods of raising two crops of paddy seem to have caught the imagination of the growers in Wynad. In the course of the past three years, the area under second crop paddy has steadily increased from practically nothing in 1950-51 to over 500 acres in 1954-55. This would mean that the Wynad growers have contributed in a measure towards food production and have earned for themselves an additional income of Rs. 1,14,000/-. If the above practice of double cropping is adopted on a more extensive scale, it will help to narrow down the rice deficiency in this district considerably.

Thanks are due to Sri K. Ramaswami, Paddy Specialist, who has given valuable guidance in preparing this note.

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Sugarcane yield competitions in Madras State

by

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Genesis: It is now four years since the first award was given for the highest yield of sugarcane in this State. In 1951, a high-yielding crop of sugarcane was noted in Kuniamuthur near Coimbatore. Sri N. L. Dutt, Director of the Sugarcane Breeding Institute was so much impressed with this crop that he arranged for an estimation of its yield. It recorded an average of 97 tons of cane over six acres. Sri Venu Naidu, the cultivator was honoured at the Coimbatore Agricultural College Day Conference. Subsequent to this, a scheme was suggested to the State Government and this is still in force from 1951–'52. The highest yields recorded in the last four years are 102·4 tons, 107·12 tons, 94 tons and 129 tons respectively.

Objectives: The yield estimates are from small plots and hence are liable for error in estimation. Still the Government-sponsored scheme achieved its objective in rousing the ryots towards increased production. The average yield in development zones has increased from about 25 tons to 35 tons of cane per acre. The average in Nellikuppam factory itself has recorded a definite increase.

The objective before the ryots may be fixed as 50 tons of cane with 12·5% sugar recovery. It is not possible for all to achieve an average of 70 tons of cane per acre. It is more difficult to produce 70 tons of cane with 7·16 tons sugar per acre as in prize plots, than 50 tons with 6·25 tons sugar per acre.

The prize winners are normally resourceful ryots and do not usually look for profit from prize plots. Achievement of high yield may depress quality, if the increased production is not properly planned.

The objectives are therefore to produce good yields of high quality canes for ryots and high efficiency in extraction of sugar from cane by the factory.

Yield potential: When talking of yields, it is often mentioned that the yield in India is low. This is true in regard to subtropical

India. The yield of cane and sugar per acre in different countries are presented below.

TABLE I

Yield of cane and sugar recovery in different countries and in different States.

Country	Average yield of sugarcane per acre	Sugar recovery percent
Australia	21·34	14·33
Cuba	17·12	12·25
Mauritius	19·63	12·08
Louisiana	19·84	8·06
Puerto Rico	24·16	12·23
Java	56·00	11·49
Hawaii	62·05	10·46
India	13·50	9·98
East Punjab	17.80	9·41
Bihar	16·10	10·32
Bombay	40·50	11·08
Madras	33·50	8·62
Uttar Pradesh	18·40	9·27

It is seen that sugarcane yields in Madras compare favourably and it ranks fourth in the world.

In respect of quality, Australia leads the world. Cane per acre there is 21·34 tons with 3·06 tons sugar per acre, while in Madras it is 33·5 tons with 2-89 tons sugar. In a thickly populated country like ours, production per acre and cost are the criteria and not the recovery percent alone. Even in respect of cost cane or sugar, the cost towards land lease in Madras forms 20 to 40% and this is purely non-agricultural. The economics of our country do not permit of aiming at quality alone. It is sugar per acre combined with quality and cost.

Efficiency in field and factory: The yield potential according to agrobiologists is 197 tons, while ryots here have achieved 129 tons; i. e. 65·5%; the average yield in this State is 35 tons; i. e. 17.7% of the potential. The sugar factories achieve an over-all efficiency of about 83 – 85 per cent. Therefore, the cane grower is far behind the potential and he definitely requires more help in reaching the maximum potential.

The Coimbatore canes are potential of high yield and the best yield out of them is yet to be achieved. The average ryot lacks timely help for manuring his field or irrigating it. Research on pests and diseases have not progressed beyond the doubtful uses of chemicals in respect of sugarcane. The high-yielding new varieties take larger quantities of nutrients from the soil both from surface and from depths. The soil therefore requires to be replenished progressively to a greater extent. Prevention of deterioraton of varieties due to ill-balanced nutrition and diseases is an important aspect. It is not known to what extent the natural fertility of soil is impaired by the production of high yields as in prize plots.

Our Needs: There is an urgent need to expand the sugar industry in the state. The total requirement of sugar for Madras is estimated at about 1,30,000 tons in thc next few years. Our present production is only about 40,000 tons. With one more factory coming up in Tanjore, our production may go up to 55,000 tons. It is not possible to forecast as to how many of the projected factories wil come into production in the near future.

The per capita consumption of sugar in Madras is 4½ lb. plus 12 lb. of *gur*. Compare this with the per capita consumption of sugar in other parts of the world. It is reported to be 143 lb. in Australia.

Out of about 1·20 lakh acres under sugarcane only about 20,000 acres are crushed by sugar factories. The balance of cane is converted to *gur*. The loss of sugar in baggase etc. in *gur* making is about 35%, while it is only 20% in a sugar factory.

TABLE II

	Gur manufacture	Sugar manufacture
Sugar percent on cane	12·0	12 0
Juice extraction percent on cane	60	...
Sugar extraction percent (i. e. overall efficiency)	...	80
Jaggery recovery percent	11	...
Sugar percent in *gur*	70	...
Recovery of sugar percent cane	7·7	9.6
Loss in extraction percent cane	4·3	2·0
Percent loss of sugar	35·8	20·0

Cane is therefore better utilised in a sugar factory than by a ryot in making *gur*. Increased production of cane in a *gur* area is faced with the technological problem of converting it to *gur*, as the latter does not set well. The increased production also cannot be efficiently utilised. It is for such reasons that the Agricultural Department has not proposed yield competitions in *gur* areas.

The economics of *gur* are different from those of sugar. The ryots in *gur* areas are advised to take active steps for erecting sugar factories; as otherwise, they cannot step up their yields and achieve a high standard of efficiency.

Payment for quality: The sugar industry in India did not progress much in the field of research during the period of protection from 1932 – '1950. When payment on weight of cane was made the ryots achieved high yields, even though it was at the sacrifice of quality. He is not to be blamed for this.

Madras, particularly the ryots and the sugar factory at Nellikuppam led the way in exploring the means of improving quality of cane. In the early stages, payment was made on the basis of *gur* recovery and later premia for varieties and *adsali* were paid. The latest in the field here is the SISMA formula and some preliminary tests conducted at Samalkot have proved the possibilities of payment on quality basis. The Government of India have appointed an expert Committee under the chairmanship of Sri P. A. Gopalakrishnan, I. C. S. Madras should be in a position to suggest a suitable formula, if not on an all-India basis, at least on a regional basis.

While awards of prizes may indicate the general direction towards our goal, it will not lead us there. The ryots of Pugalur, may get about Rs. 4 - 5 lakhs as reward for 10·52% in the last season. The factory authorities have paid several lakhs in the past as premia for quality. The award of Rs. 20,000 as prizes in yield competitions at Nellikuppam is probably the biggest award in India. The sugar factory authorities and the ryots deserve all praise for the progressive policy they have adopted so far.

The small ryot: The small ryot is alert to profit and can ill afford to look for publicity. The cost of cane from prize plots may be more than that from a small ryot. But the production per acre is small and it is not tuned to the needs of the State. He needs help for manuring irrigating and harvesting the crop. Given these

aids, he can increase the average production. The small ryot cannot compete on equal terms with the prize-winners here and his potentials are placed on a different level. He can benefit only from development aids and payment of price on quality basis. The average yield which has now increased to about 35 tons, may soon increase to 50 tons in the next few years.

Research Notes

A Note on the occurrence of the 'Phyllody' Disease in Certain Sesame *(Sesamum orientale L.)* Types and their Behaviour

One of the common diseases of the cultivated gingelly (*til*) crop is a virus disease called 'phyllody' which transforms the flowers on the main axis and branches of the plant into cup-like, leafy growths. The capsules also when set, are either malformed or not formed at all. Odell (1925) and Kashi Ram (1931) reported this transformation of the vegetative parts as the sepaloid condition and found that this phenomenon though not heritable, was influenced by seasonal conditions. Rhind (1935) met with such sepaloid plants in both the late and early Burmese types when sown earlier than the normal season and attributed that a longer light period for the late types caused this abnormality. Rhind and Thein (1932) found variation in the incidence of the disease between different types and also with the season. They also observed that sepaloidy was more prevalent in the unbranched types than branched ones. Pal and Pushkarnath (1935) reported that it was possible to transmit the disease by grafting. In Sind a black-seeded variety was found to be fairly resistant to phyllody (Vacchani, 1945).

Gingelly is generally cultivated in the Madras State during two seasons viz., the cold weather season (November–December to February–March) and the Summer season (February–April to May–July). It is sometimes raised in certain tracts during the monsoon season (June-July

to October–November) also, but the area cropped during this season is very limited. From past experience the disease has been observed to occur to a noticeable extent in the crops raised during the monsoon and summer seasons.

Utilising the extensive collection of gingelly varieties and types maintained at the Agricultural Research Station, Tindivanam, observations on the incidence of the disease, conditions favouring the same, behaviour of the different varieties with regard to resistance and susceptibility were made for a period of three years. The crops were raised during the summer season in all the three years. Counts of affected plants were taken at the time of harvest and their percentage to the total population in the plot was calculated for assessing the degree of resistance to the disease. The varieties were sown in randomised and replicated plots. The results obtained therefrom are given below :—

S. No.	Varieties	Percentage of 'phyllody' attacked plants		
		I Year	II Year	III Year
1.	S.1.1 South Arcot Local ...	2·16	16·4	14·0
2.	S.1.89 Palni ...	0·36	20·8	21·0
3.	S.1.53 Malan ...	0·92	1·9	2·6
4.	S.1.57 Tekkajan ...	0·80	21·0	23·8
5.	S.1.246 Barisol ...	0·37	4·3	7·3
6.	S.1.249 Talma ...	0·80	3·8	6·9
7.	S.1.251 Jessore ...	30 66	78·4	83·0
8.	S.1.152 Jaipal Bang ...	1·15	3·9	—
9.	S.1.778 Entebbe Uganda ...	1·82	0 9	—
10.	S.1.867 Salem ...	—	14·1	12·2
11.	S.1.871 Kandikuppam ...	0 37	12·9	12·2
12.	S.1.911 Kudligi ...	1·53	8·2	5·3

From the figures of infection recorded during these years, it will be seen that the variety 'Entebbe Uganda' (S.1.778) appears to be highly resistant to the phyllody attack while the variety 'Jessore' (S.1.251) is highly susceptible to the disease. Similar observations on the monsoon crop are also being recorded.

An experiment was also carried out both at the Agricultural Research Station, Tindivanam and Oilseeds Section, Coimbatore for a period of three years during the summer season to find out whether the attack of the 'phyllody' disease could be warded off by changing the sowing time. The experimental plots under the different treatments

were sown at fortnightly intervals commencing one month ahead and after the normal sowing time. Though no significant differences between them in respect of incidence of the disease were obtained, still there was an indication to the effect that the incidence of the disease was greater in the late-sown crop. The three improved strains of gingelly (viz. TMV.1, TMV.2, and TMV.3) showed a similar reaction to the attack of the disease. At Coimbatore it was also observed that seeds from the badly phyllody-attacked plants when sown during next summer season gave rise to normal plants.

From the observations recorded in this note it will be seen that the findings generally are in agreement with those of earlier workers. Both the resistant and susceptible varieties are being observed further for their susceptibility to phyllody attack. To determine whether this character is governed by Mendelian inheritance, hybridization work between the resistance and susceptible forms is also being undertaken.

The authors are thankful to Sri C. R. Seshadri, Oilseeds Specialist for his valuable guidance during the course of this investigation.

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Note on the White Fly—(*Aleurolobus barodenses* Mask) and its control in the Madras State

Introduction: Like other crops, sugarcane is a victim of many pests, one of which is *Aleurolobus barodenses M.* popularly called mealy wing or sugarcane white fly. It was considered as only a very minor pest of sugarcane, but of late it is increasing in such large numbers that it is one of the serious pests of sugarcane now in the Madras State especially in Tiruchirapalli district. Since information on this pest under South Indian conditions is meagre, studies were made on the control of this pest, deta'ls of which are given in this short paper.

Distribution: Karan Singh (1931) records a fairly wide distribution from all over India such as Bengal, Central Provinces, the Punjab, Baroda, Pusa, Madras and Burma. Studies by Misra (1921), Karan Singh (1931) Lefroy (1909), Fletcher (1914) and Ramakrishna Iyer (1940) have given some information on the aleurodids under North Indian conditions. In South India a much wider distribution is recorded for the first time in the Madras State. The whitefly is found in the districts of Coimbatore, Tiruchirapalli, South Arcot, North Arcot and also in Mysore and Andhra State.

Nature of Damage: The fly is scattered by wind from leaf to leaf. Infested leaves are covered with all stages of the pest. When there is a heavy infestation the crop looks pale and stunted in growth. As sugarcane is planted all the year round in the Madras State, the pest can easily continue throughout the year on this crop but it appears in serious form only when the season is most favourable for multiplication.

Incidence of the pest: The incidence of the damage is localised, being confined to the cane crops where the eggs are first laid. Generally the attack is severe in young crops, but in the mature cane crop, it was sometimes seen in serious form in Tiruchirapalli district (Madras) during 1953. The cane crop planted in March in the Tiruchirapalli district is subject to severe attack by this pest in May and June and the whole crop looks pale yellow, rusty and stunted. The most susceptible variety to this pest was observed to be Co. 419, as compared to the other cane varieties. When there is drought or when the cane crop is grown under neglected conditions, this pest is seen in serious form. Infested leaves turn reddish due to loss of sap. The maximum activity of the pest, therefore, occurs at high temperatures and low humidity with no rainfall.

Life-History: Eggs are laid in rows on the under-surface of cane leaf during the winter. Nymphs, puparia and adults are seen during December, January and February. Eggs when freshly laid are pale-white and turn sepia in a day or two. They are generally laid near the

mid-rib or any part of the lower surface of the leaf. Nymphs are yellow at first and later on they turn grey, light black and shiny black. It completes its life-cycle in 24 to 25 days. Hence there will be easily 13 to 15 generations in an year with slight variations in the life history.

Materials and Methods: The experiments were carried out during April 1953 at Karur in Tiruchirapalli district in the Madras State. The insecticidal trials were conducted as sprays on Co.419, one of the most susceptible varieties. The crop was eight months old at the time of the trials. The area of each plot was 22 by 120 feet and six treatments were replicated four times.

The treatments were as follows:

(1) Sytam (½ oz. in 2 gallons of water)–0·15% (Systemic insecticide).

(2) Parathion (½ oz. in 2·5 gallons of water)–0·025%, (Synthetic insecticide).

(3) Control.

(4) BHC 520–12 oz. in 2·5 gallons of water; 0·2%, (Synthetic insecticide).

(5) BHC 520–6 oz. in 2·5 gallons of water; 0·1%, (Synthetic insecticide).

(6) Fish oil rosin soap–½ lb. in 2 gallons of water 2·5%.

A preliminary count of the population was taken just before spraying. Later the mortality counts after spray were taken in six leaves over a length of four inches (one inch space being at 4 different places in a leaf) in each leaf after 24 hours, 48 hours and 72 hours. The data gathered on the trials are summarised below:—

Treatment	Strength	Population before spray	Percentage of mortality after spray		
			24 hours	48 hours	72 hours
1. Sytam	0·15%	155	61·7	30·5	71·9
2. Parathion	0·025%	187	70·9	85·9	58·3
3. Control	—	292	—	—	—
4. BHC	0·2%	155	77·5	98·8	76·5
5. BHC	0·1%	181	89·3	98·1	73·3
6. F. O. R. S.	2·5	252	20·9	64·9	40·9

The results show the high efficacy of BHC at 0·2% and 0·1%, Parathion 0·25% and their superiority over fish oil rosin soap and Sytam. To obtain an immediate mortality of the pest, BHC at 0·2% concentration is found to be better than all the other insecticides tried.

Alternative hosts: A number of varieties of *Saccharum spontaneum* serve as alternative host plants, on which it thrives very well. The most susceptible varieties of *Saccharum spontaneum* are SES. 13, 14, 28, 45, 77, 78, 85 E and 88 C. Two parasites (*Cardeogaster semundus* Mani and *Azotus deltricusis* Lal) have been recorded on *Aleurolobus barodenses M.* and the most important and common parasite observed by the author is *Azotus delhiensis* Lal. The percentage of parasitisation in nature ranged from 19 to 35 in Tiruchirapalli district during the month of April. Similar observations were made in Coimbatore district during May 1953, the percentage of parasitation ranging from 70 to 80.

Summary: The whitefly, *Aleurolobus barodenses*, though considered to be only a minor pest till recently, became a serious pest in Madras especially in Tiruchirapalli district during 1953. BHC 0·2% has given good effect against the pest. Subsequently trials with Parathion, has also given encouraging results, but as it is a poisonous insecticide it should be used with extreme caution. *Saccharum spontaneum* and a few other species of grasses belonging to the same genus are highly susceptible to this pest. Co.419 is highly susceptible to this pest, as compared with other cane varieties such as Co. 527 and 449. The most common parasite, *Azotus delhiensis* L. found on this scale and this can be well utilised for the biological control of this scale.

Acknowledgements: Thanks are due to the Indian Central Sugarcane Committee, New Delhi, under whose auspices this work was undertaken in the Madras State and which shared the finances of this Sugarcane Pests Scheme along with the Madras Government on a 50:50 basis. Acknowledgements are also due to Sri. N. L. Dutt, Director of Sugarcane Breeding Institute, Coimbatore, who was kind enough to give the names of the varieties of *Saccharum spontaneum*.

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Statement showing the Rainfall, Humidity and Temperature for the year—1953
(Tiruchirapalli)

Month	Mean Humidity in % 8–30 A.M.	Mean Humidity in % 2–30 P.M.	Total rain-fall in inches	Mean Maximum Tempera-ture °F	Mean Minimum Tempera-ture °F
January	79	53	0·81	87·4	69·7
February	78	46	0·99	91·1	71·4
March	71	34	0·00	96·0	73·6
April	70	44	0·45	99·1	79 9
May	65	42	0·44	101·2	81·5
June	55	36	0 00	100·5	81·3
July	61	41	5·45	95·1	79·0
August	61	44	1·88	96·2	79·1
September	65	42	0·02	96·4	78·0
October	75	61	4·41	92·1	75·7
November	70	58	1·14	89·1	74·1
December	80	69	6·96	84·8	71·5
Mean	69	47	22·55	94·1	76·2

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Review

Poona Agricultural College Magazine: Vol. 46, No. 2 & 3 Aug. – Nov. 1955- Special Millet Number. Rs. 5/- pp. 259. Edited by Dr. G. A. Patel.

This special number, solely on Millets is prefaced by the inaugural address by Sri. Punjab Rao Deshmukh, Union Minister for Agriculture, and gives a comprehensive view of the various items of research that are being conducted by the Agricultural Department of Bombay State. Apart from breeding for improvement of yield it contains an account of extensive work on agronomical researches, pest and disease resistance, drought resistance, conservation of soil moisture and its effect on sorghum crop. This serves a useful purpose of conveying to Millet workers in other States the programme of work and the achievements so far attained by the Bombay Department of Agriculture,. A useful bibliography, though not exhaustive, has been appended at the end on the eight millets. A few printers' mistakes appear here and there, such as the chromosome number 2n=26 instead of 2n=20 for *S. nitidum* on p. 81 and *S. alum* instead of *S. almum* and *S. sudanensis* instead of *S. sudanense* on p. 110. [N. K. S.]

Gleanings

Chemical Caponisation: The chemical method of caponisation (by injecting the hormone stilboestrol) produced birds equal in growth and quality with birds which had been surgically caponised. There is some gain by the chemical method of caponisation in that (a) there is less likelihood of losses which may occur when birds are surgically caponised, and (b) there is no check or setback for birds which are chemically caponised. The effect of injecting stilboestrol tablets' becomes obvious within the first month after the injection. There is a significant difference in the quality of the carcass of a capon and that of a cockerel, both in market appearance when it is killed and plucked and also in palatability, when it is cooked and eaten. Australorp X White Leghorn cockerels, if caponised, reach their prime for marketing and palatability as capons at from 21 to 22 weeks of age, when treatment with stilboestrol is started at 10 weeks of age. [T. R. N.]

New Zealand Joarnal of Agriculture, January 1954. Vol 88. (1)

Pure cultures of fungi produced by ants: It has been observed that several species of ants are able to cultivate and maintain a *pure* culture of some particular species of fungi. Such ants are termed as *Attine* ants. These ants are found exclusively in the tropical regions of the New World. Each nest of the *Attine* ants, has a fungal garden of some single species, cultivated by the ants on a vegetable substrate. How the ants maintain the fungus in a pure form without contamination, has been an interesting problem for [mycologists. The fungal garden in any nest, becomes contaminated and overwhelmed, soon after the ants are removed. Also, it has not been possible to cultivate a pure culture of these fungi, on agar media. The ants are dependent on these fungi for their feed. The fungi, maintained by *Attine* ants, have not been recognized so far.

It is postulated that the salivary and anal secretions of the ants may play a primary role in maintaining the culture in a pure form. Because of the habit of stripping the leaves of economic plants, the *attine* ants must be ranked as major agricultural pests. (Identifications of these fungi are desired, *and cultures* will be sent to mycologists on request). [N. K, S.]

(Neal A. Weber, Science–1955: 121 : p. 109)

Recent Researches on the Sea Island Cotton in Madras State: Attempts are being made for the past six years to introduce Sea Island Cotton in the West Coast of Madras in the districts of South Malabar, Kanara, as a rain-grown crop in the 'Modan' and 'Kumeri' lands respectively. The results have indicated so far that varieties like 'Andrews' or 'Montserrat' thrive well and with proper attention fetch remunerative yields up to 1200 lb. of seed cotton per acre in favourable years. Planting may be done on ridges by direct seed sowing in June in South Malabar and by transplanting in South Kanara.. It is not desirable to sow the crop in beds and on flat ground, particularly in South Kanara where the rainfall is torrential and chances for erosion and water-logging occur, which cause seedling mortality, incidence of blackarm and poor growth in the case of surviving plants. A basal dose of 3 tons of farmyard manure plus 30 lb. of P_2O_5 as superphosphate plus 50 lb. of K_2 and 50 lb. lime per acre should be applied with a top dressing of 60 lb. of Nitrogen as ammonium sulphate or Chilean nitrate in two split doses, for raising a successful crop. The crop should be protected from pests like jassids, boll-worm etc, by application of pesticides like Folidol. A spacing of 2½ feet between rows and 1 foot between plants in the row is desirable to establish proper growth and development of branches. Care is also neccessary during picking and good locules are to be sorted out. The land should be kept free from weeds, both in the seedling stage and the later stages

of growth and intercultivation is neccessary. The crop that is sown in June with the onset of monsoon will complete its harvest by the end of December or early in January. The lint that is finally obtained after careful ginuing has a staple length of 1¼ inches in the case of Andrews and 1½ inches in Montserrat and spins 80 and 100 counts respectively. The yarn is very strong and is suitable for the manufacture of sewing threads, parachute cloth and in rubber tyre manufacture etc. Thus this special purpose cotton has a great future in the industrial economy of the Indian Union and its cultivation may be tried on the West Coast in suitable centres, under proper attention as suggested above. It is also very necessary to instal suitable machinery to utilise this cotton properly.

Tomato Seed — Method of Extraction: If you want to collect tomato seed seed, keep a careful watch over the plants earmarked for this purpose. Watch the plants from time to time for the colour of the green as well as the ripe fruits, as also for their shape and size. Pull out all diseased plants and those that are not true to type, Allow the selected fruits to ripen on the plants. For extracting seed, first cut the fruits into halves and squeeze out the pulp into a vessel made of a non-corrosive material. Allow the pulp to ferment for two to five days, depending on the season. When the seed settles down at the bottom of the container, remove the pulp. The remaining seed can also be removed from the pulp by repeatedly washing the pulp, stirring it and pouring off the liquid. Thinly spread out the seed and dry it in the shade. [I. C. A. R.]

Scientists explore Effects of Tea Drinking: Psychological tests reveal that a cup of tea gives both an immediate and a delayed lift without inducing secondary depressing effects. Pharmacologists report that beverage tea tends to facilitate actual effort, to diminish drowsiness and fatigue, and to produce a sensation of comfort and cheerfulnes without being followed by depression. The unpleasant gastric reactions or insomnia that occasionaly occur when caffeine or tannins alone are ingested in beverages or when they are administered parenterally, are not produced by drinking tea. Tea, on the contrary, because of the combination of these components produces a mild and pleasant, stimulating and also a soothing effect upon the gastric processes.

Dr. Frohman, in speaking of the vitamin content of tea, reminds us that 'occasionally forgotten is the fact that caffeineo is not the only physiologically effective substance found in tea. Also present are volatile oils, certain trace elements and B vitamins, proteins, chlorophyll, various carbohydrates, and finally water-solubles of tannin, sometimes erroneously called tannic acid, as well as appreciible amounts of riboflavin (Vitamin B-2) and pantothenic acid-a substance regularly associated with riboflavin. Fresh green tea leaf is rich in vitamin C, almost comparable with fresh lemon juice. Tea can be considered nutritional but not a high-calorie beverage, and is therefore excellent for the obese person. This is especially true in summer when the liquid intake naturally increases. From 2½ to 4 quarts of water can be lost through normal perspiration on a hot day; in fact, this loss has been known to reach to 6 quarts under extreme conditions. Thus it is of the utmost importance for the overweight person to know what beverages (other than water) will replace his fluid loss without adding to his adipose tissue. Tea is one of the happier answers to this question.

A lack of riboflavin is evidenced by poor growth in the young and by digestive depression and lowered vitality at any age. It is also considered an important factor as a deterrent to the ageing process. Riboflavin cannot be stored in the body and therefore should be included in the daily diet.

Dr. Henry, J, L. Marriott, Associate Professor of Medicine, University of Maryland stated that 'Tea is a beverage that is allowed in almost every medically prescribed diet. In the Diet Manual of the Mayo Clinic, for example, tea is permitted in all diets except those catering to acute gastric emergencies. By some authorities tea is considered the beverage most suitable for any disease of the digestive system. [T. R. N.]

The Planters' Chronicle — October 15, 1955. Vol. L. (No. 20.) Page 350-551.

Notes and News

The 46th. Madras Agricultural College Students" Club day was celebrated on the 9th. March with the Director of Agriculture, Madras, Sri. P. P. I. Vaidyanathan, I. C. S., in the chair. Sri. R. Balasubramaniam, Principal, welcomed the President and the other distinguished guests. After presentation of the reports on the literary and sports activites of the club the President distributed the prizes to the several winners. In the course of his address the President made special mention of the excellent health and good physique of the students of this college and dealt with the expansion that is programmed in the development of agriculture and rural improvement in the Second Five year Ran. He placed before the audience the important role that the students of this college will be called upon to play in the national development hereafter. Dr. A. Mariakulandai, the Vice-President of the Students' Club proposed the vote of thanks. The students then entertained the audience with a series of well-staged dramatic pieces.

For the first time in the annals of the Agricultural College, Coimbatore, 15 students of the Second Year B. Sc., (Ag.) class with Sri. U. S. Sree Ramulu as Student Representative and Sri S. Venugopal, Assistant Lecturer in Entomology as Staff Leader left Coimbatore on 15-2-56 on an All-India Tour under the Youth Welfare Programme sponsored by the Government of India. They visited Poona, Bombay, Agra, Delhi, Nagpur, Hyderabad, Bapatla and Madras and returned on 3-3-1956. In addition to visiting important places like the Meteorological Station and the National Chemical Laboratories at Poona, Prince of Wales Museum, and the Tharaporevala Aquarium at Bombay, the Taj Mahal at Agra, Red Fort, Rajghat, Birla Mandir, Birla House etc. at Delhi, they also visited all the Agricultural Colleges, and Agricultural Research Institute like the Pusa Institute and Science College. They had the unique opportunity of visiting both the Houses of the Parliament in session at Delhi and also seeing the Shah of Iran at Hyderabad. The students owe a great debt of gratitude to all those who helped them during the tour. The tour was of great educative value and widened their outlook and it is hoped that it will become a regular annual feature thereafter.

Weather Review — For February, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·1	— 0·3	1·4
	Tirurkuppam*	Nil	— 0·2	1·3
	Vellore	0·1	— 0·2	0·9
	Gudiyatham*	Nil	— £	0·6
East Coast	Palur*	Nil	— 0·3	1·1
	Tindivanam*	Nil	— 0·3	1·6
	Cuddalore	Nil	— 0·9	0·7
	Nagapattinam	0·1	— 0·7	2·7
	Aduthurai*	Nil	— 0·8	2·1
	Pattukottai*	Nil	— 1·0	2·6
Central	Salem	Nil	— 0·3	0·3
	Coimbatore (A. M. O.)*	Tr.	— 0·4	0·1
	Coimbatore	Nil	— 0·4	Tr.
	Tiruchirapalli	Nil	— 0·3	0·5

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
South	Madurai	Nil	— 0·5	1·3
	Pamban	Nil	— 0·9	0·6
	Koilpatti*	Nil	— 0·3	0·7
	Palayamcottai	Nil	— 1·2	3·0
	Ambasamudram*	0·1	— 0·5	3·3
West Coast	Trivandrum	Nil	— 0·8	0·8
	Fort Cochin	4·4	+ 3·6	4·4
	Pattambi*	0·9	+ 0·1	1·1
	Kozhikode	Nil	— 0·7	Nil
	Taliparamba*	Nil	— 0·2	Nil
	Wynaad*	1·1	+ 0·4	1·1
	Nileshwar*	Nil	— 0·1	Nil
	Pilicode*	Nil	— 0·1	Nil
	Mangalore	Nil	— 0·2	Nil
	Kankanady*	Nil	— 0·1	Nil
Hills	Kodaikanal	1·2	— 1·3	2·1
	Coonoor*	0·1	— 2·5	2·7
	Ootacamund*	Nil	— 0·5	0·3
	Nanjanad*	Nil	— 0·6	0·2

Note :— * Meteorological Stations of the Madras Agric. Dept.
Tr = Trace (0·01″ to 0·04″)
£ = Actual Deviation is 0·02″.

The weather was practically dry in the first four days of the month. On 5—2—1956 localised showers were received in Travancore-Cochin and at a few places in north coastal Andhradesa. Localised showers were received on the next day also at a few places in Coastal Andhradesa. The weather became dry again on 7—2—1956. On 8—2—1956, widespread thunder-showers were received in Travancore-Cochin. About 350 miles South—South-West of Port Blair a depression was noticed in the Bay of Bengal on 9—2—1956 and on the third day of its formation it weakened into a shallow depression. Thundershowers were fairly widespread on 9—2—1956 in Travancore-Cochin and at a few places in Mysore. The weather from 10—2—1956 to 24—2—1956, both days inclusive, was mainly dry throughout the region. But during this period there were fluctuations in the night temperatures. On 25—2—1956 a few light showers were received at a few places in Tamilnad and this sort of weather continued on the next day also. The weather in the last three days of the month was mainly dry with mild variations in the night temperatures.

An earthquake of moderate intensity at its origin was noted in the Pacific Ocean, about 3880 miles away from Madras at 7-22 P. M. on 1—2—1956.

Monsoon Rainfall Summary (June to September 1955)

This year's monsoon will be remembered for its vagaries, particularly its abnormal activity towards the fag end of the season, which was unusually prolonged and carried well into the month of October. The monsoon set in good time and kept up its normal activity during the first month. But thereafter, the monsoon weakened considerably, particularly in July. It revived over the country towards the end of July and it finally withdrew from the country only by the 15th of October. (Supplement to the Indian Daily Weather Report for 17—11—1955).

Considering the month of February 1956, as a whole the rains were uniformly sub-normal throughout the region with the exceptions of Fort Cochin, Wynaad and Pattambi. Mainly dry weather was experienced throughout the month.

The noteworthy rainfalls and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
8/2/56	Fort Cochin	3·0	North	0·05	— 0·2	Far below normal
do.	Alleppey	1·5	East Coast	0·02	— 0·7	do.
			Central	Nfl	— 1·3	do.
			South	0·02	— 1·1	do.
			West Coast	0·64	+ 0·2	Above normal
			Hills	0·08	— 1·2	Far below normal

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 15—3—1956.

C. B. M. & M. V. J.

Departmental Notification

Gazetted Service — Postings and Transfers

Name and present post	Posted as
Kanakaraj David, S., Lecturer in Entomology, Coimbatore,	Gazetted Assistant in Entomology, Coimbatore
Muthuswami Iyer, S., Additional D. A. O., Tanjore,	D. A. O., Sattur
Nagarajan, K. R., Assistant, Entomologist, Coimbatore,	P. P. O., (Entomology) Coimbatore
Raman Moosad, C , (On reversion)	Special Assistant Marketing Officer, Livestock, Hosur
Seshadri, A. R., Lecturer in Entomology,	Assistant Entomologist, Aduthurai
Subramania Sarma, A.H., Special Assistant Marketing Officer, Livestock, Hosur,	Lecturer in Agriculture, Coimbatore
Uthaman, P., S. D. O., Vellore,	Assistant Paddy Specialist, Pattambi
Srinivasan, S., Superintendent, A. R. S., Aduthrai,	S. D. O. Vellore
Abdul Samad, Superintendent, A. R. S. Pattambi,	Oil-Seeds Specialist, Coimbatore

Upper Subordinates

Name and present post	Posted as
Abraham, E. V., Entomology, Assistant, Aduthurai,	Entomology Assistant, Cashownut Scheme, Coimbatore
Arumugavel, N. R., A. D., Tanjore,	A. D., Jayankondan
Abdul Khader, M., A. D. Pattukottai,	A. D. Kulithalai
Boominathan, E., Certification Inspector, Coimbatore,	Certification Inspector, Rajapalayam
Elumalai, T., A. D. Cheyyur,	Extension Officer in Agriculture, Kadambathur
Gnanasambandam, B., A. D. Muthupet,	Special Marketing Assistant, Thiruthuraipoondi
Jayaraj, M. V., A. D. Paramakudi,	Do. Do. Paramakudi
Kumaran, V., Soil Conservation Assistant,	Soil Conservation Assistant, Vellore
Lakshmanan, T. S., Assistant in Chemistry, Coimbatore,	Assistant Lecturer in Chemistry, Coimbatore
Mathew, V. G., A. D., Cheyyur,	Pepper Development Assistant, Kanhangad
Masilamani, S., Soil Conservation Assistant, Satyamangalam,	A. D., Kadpadi
Mohamad Ibrahim, P. K., Assistant in O. S. Pilicode,	Coconut Nursery Assistant, Adirampatnam, Tanjore
Narayanan Nambiar, P. K., Coconut Nursery Assistant, Adirampatnam,	Oil Seed Assistant, Pilicode
Nagaraja Rao, K. R., P. P. O., Coimbatore,	Assistant in Entomology, Coimbatore
Narasimhan, R., A. D., Orthanad,	Special Marketing Assistant, Tanjore
Perumal A. S., A. D., Tuticorin,	Do. Do. Pudukottai
Peter, S. D., Certification Inspector, Gobichettipalayam,	Certification Inspector, Rajapalayam
Ramakrishnan, C., Chemistry Assistant, Coimbatore,	Mycology Assistant, Coimbatore
Ramiah, S., Certification Inspector, Pollachi,	Certification Inspector, Rajapalayam
Ramalingam, A. N., Soil Conservation, Mulanur,	Soil Conservation Assistant, Satyamangalam
Shanmugasundaram, N., A. D., Vedasandur,	Special Marketing Assistant, Madurai
Sivaraman, A. K., A. D.. Pennadam,	Coconut Nursery Assistant, Nileshwar
Sundaram, N. V., Mycology Assistant, Coimbatore,	Mycology Assistant, Cashewnut Scheme, Coimbatore
Sivasubramaniam, T., Trainee in Soil Conservation Scheme, Ootacamund,	Soil Conservation Assistant, Avanashi and Coimbatore
Srinivasan, K. V., A. D. Jayankondan,	A. D., Tanjore
Subramaniam, K. P., Extension Officer in Agriculture, Kadambathur,	A. D., Vellore
Seshagiri Rao, T., Assistant Lecturer, Chemistry, Coimbatore	Assistant in Chemistry, Coimbatore
Subramaniam, N., A. D., Dharmapuri,	Soil Conservation Assistant, Vellore
Srirangaswami, Soil Conservation Assistant, Satyamangalam,	Soil Conservation Assistant, Avanashi and Coimbatore
Vrishabadass, C., A. D., Sankarapuram,	Special Marketing Assistant, Pattukottai
Ummerkutty, O. V., Coconut Nursary Assistant, Nileshwar,	Assistant in Oilseeds, Badagara

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

CROPS
COTTON; GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Ghee and Butter Trade in Coimbatore District

by

R. MADHAVACHARY, B. Sc. (Ag.)
Marketing Assistant, Madras.

Ghee is one of the chief byproducts of milk and is also a handy form for the disposal of surplus milk without spoilage.

The total output of milk products in Madras State is estimated as below:

	Quantity in tons
Milk	8,45,400
Butter (consumed as butter) ...	250
Ghee	13,800
Curd	1,28,055
Khoa and other milk products ...	500

In Madras State, the chief ghee-producing areas are Coimbatore, Salem, Tiruchirapalli, Madurai and to a little extent Ramanathapuram and Tirunelveli districts. However among all these, Coimbatore district ranks as first both in overall milk production and preparation of ghee. The table below gives in detail the estimated production of milk and the ghee in the various districts of Madras State.

District	Total production of milk, in tons	Total potential output of ghee, in tons
Coimbatore	1,26,300	2,046
Tiruchirapalli	1,07,100	1,928

District	Total production of milk, in tons	Total potential output of ghee, in tons
Salem	1,11,200	1,775
Madurai	66,600	1,106
South Arcot	82,600	1,167
Chingleput	67,400	1,139
Tanjore	53,000	1,009
North Arcot	63,900	988
Tirunelveli	47,100	845
Ramanathapuram	45,800	729
Malabar	39,700	495
South Kanara	30,200	498
Nilgiris	4,500	75
Total, Madras	8,45,400	13,800

In Coimbatore district the production of ghee is not uniformly spread out, but is confined to only seven taluks out of the ten taluks. The quantities of ghee estimated to be produced annually in Coimbatore district, are as below:

Name of the taluk			Estimated actual production of ghee in tons
Dharapuram		...	300
Palladam		...	300
Erode and Gobichettipalayam		...	400
Bhavani		...	40
Coimbatore		...	30
Avanashi		...	30
Pollachi	50		
Udumalpet	40	...	120
Kollegal	30		

Butter or Ghee production is a cottage industry, scattered about in houses of medium and low income group families and is largely in the hands of the women folk. It is usual in such farm houses to keep, according to capacity one or more milch cattle, either a cow or buffalo or both. Each day's collection of milk is boiled, cooled and set to ripen with the addition of a little buttermilk as starter. The ripened milk is churned the next day and the butter is extracted. The daily collection of butter in most cases is less than a pound a day and is stored in mud pots, with a little fresh buttermilk. Collections of each day are accumulated upto about a week and then sold, either as butter or as ghee after melting.

The trade in butter fat has developed partly in the shape of butter to be converted ultimately into ghee and partly as ghee

itself from the chief production centres. Almost every village or town is a production centre where the surplus milk from each day's collection is partly converted into butter for ghee production. In the overall picture this quantity is liable to wide variations from year to year, based on the demand for milk. In spite of the keen demand for milk, particularly in urban centres, small surpluses are left over with milk dealers on many days. A part of this milk, which cannot be disposed of in any other form is made into butter. This surplus milk is relatively small in urban centres and areas of highly developed arable farming where the population is also high. In areas remote from towns and where the population is comparatively less dense the surplus of milk is relatively higher. The scope for preparations like Khoa is also very limited in these areas. Such areas therefore become established ghee-production centres and a few of these happen to be cattle-breeding centres also. Centres of this kind occur in the taluks of Avanashi, Palladam, Erode, Gobichettipalayam, Coimbatore, and Dharapuram.

In Coimbatore district, ghee or butter produced in villages is marketed by two methods, viz:

(i) the villagers themselves bringing the ghee or butter to the assembling market;

(ii) the ghee or butter produced being sold at the village site itself to merchant's agents.

The producers from villages bring their ghee in mud pots as headloads representing the collection of about seven or eight days and offer them for sale to the wholesale merchant who make purchases in the shandies. Sometimes village merchants who go about in the villages bring to the shandy, their purchases (about one or two tins) of butter and offer them for sale, to the wholesale merchants. The producer, when coming to the shandies usually brings the produce in the form of only butter. However, at the time of sale, the butter is melted in the presence of the purchaser into "KATCHA" ghee. This system of purchase is resorted to because the butter offered for sale represents the collection of over a week and hence contains butter in layers of different qualities. Melting such butter to a certain extent enables the purchaser to judge the quality more easily and accurately. Agents of merchants purchasing at the village site, visit the various villages and collect from individual holdings the small quantities available as butter and arrange for its despatch as soon as a tin or two of butter is obtained.

They get a commission of Re. 1/- per tin of 40 lb. butter purchased. On an average, about a tin of 40 lb. butter can be collected if the agent visits 10 to 12 holdings in a day. The wholesaler attains a double advantage by adopting this method of purchase. Firstly, he is able to arrange for the supplies being received at regular intervals and also in a fresh condition. Secondly by the appointment of agents the wholesaler is enabled to make purchases from a much wider area. Actually by this method of purchase, merchants are able to obtain butter from villages 30 to 40 miles from the market. (Example: Coimbatore merchants purchasing butter from Dharapuram, Mulanur etc). In former years the trade in ghee or butter used to be only at the shandies but in recent years with the springing up of a large number of merchants in various centers, dealers purchase ghee or butter at the village site itself through their agents.

The important ghee or butter-assembling markets in Coimbatore district are (1) Tirupur; (2) Dharapuram; (3) Kangayam; (4) Avanashi; (5) Uthukuli; (6) Perundurai; (7) Andiyur; (8) Nambiyur; (9) Bhavani; (10) Mulanur; (11) Somanur; (12) Sulur; (13) Palladam; (14) Annur. In practically all the markets mentioned, the ghee or butter is brought for sale to the shandies once in the week, as given below:

Name of market	*Shandy day*	*Quantity brought for sale every week*
Tirupur	Tuesday	35 maunds
Dharapuram	Tuesday	70 ,,
Kangayam	Saturday	25 ,,
Avanashi	Saturday	15 ,,
Uthukuli	Monday	10 ,,
Perundurai	Monday	10 ,,
Andiyur	Wednesday	15 ,,
Nambiyur	Wednesday	10 ,,
Somanur	Monday	25 ,,
Palladam	Wednesday	25 ,,

Usually these shandies receive ghee or butter from villages within a radius of about 5 or 6 miles. It is estimated that out of the total production only about 30% is assembled in shandies and 70% is purchased in the village site itself. In these shandies more than 80% of the quantity assembled is sold in the form of "katcha" ghee while the redeeming feature in the purchases at the village site is that over 90% of the transactions is in the form of butter. However in a few centres like Uthukuli and Perundurai, there is a

practice of assembling milk from neighbouring areas by creamery men who separate cream soon after purchase of milk and prepare butter out of the cream. The creamery men seldom undertake preparation of ghee. This butter is either despatched as butter to terminal markets like Madras City or sold to merchants in ghee locally. Thus it is seen that the conversion of milk into butter (to be ultimately converted into ghee) or ghee is essentially an important outlet for the disposal of surplus milk to the best advantage.

The economics of utilising milk for ghee production may be considered next. The outturn of butter to milk ranges from 11% to 12% in the different centres (viz. Dharapuram, Uthukuli, Perundurai, Avanashi, Tirupur and Kangayam). The outturn of ghee to butter works out to 70% to 80%, the average being 75%. Thus the outturn of ghee to milk works out from 8 to 9%. The cost of production of ghee of cows and buffaloes in important markets of Coimbatore district, is as follows :—

	Tirupur & Avanashi	*Caimbatore*	*Uthukuli*	*Dharapuram Kangayam*
Cost of milk to obtain one maund of ghee	193 0 0 (900 lb. milk at 0 3 6 per lb.)	230 0 0 (920 lb. milk at 0 4 0 per lb.)	210 0 0 (950 lb. milk at 0 3 6 per lb.)	245 0 0 (1120 lb. milk at 0 3 6 per lb.)
Cost of boiling milk	2 0 0	2 0 0	2 0 0	2 0 0
Proportionate labour charges for churning and extracting butter	2 0 0	2 0 0	2 0 0	2 0 0
	197 0 0	234 0 0	214 0 0	249 0 0
Less cost of butter Milk obtained	55 0 0 (900 lb. at 0 1 0 per lb.)	86 0 0 (920 lb. at 0 1 0 per lb.)	65 0 0 (950 lb. at 0 1 0 per lb.)	105 0 0 (1120 lb. at 0 1 0 per lb.)

	Tirupur & Avanashi	*Coimbatore*	*Uthukuli*	*Dharapuram Kangayam*
Net cost for 1·1/3 maund of butter	142 0 0	148 0 0	149 0 0	144 0 0
Add labour and fuel charges for melting butter	1 0 0	1 0 0	1 0 0	1 0 0
Net cost of one maund of ghee	140 0 0	149 0 0	150 0 0	145 0 0

Having determined the cost of production of ghee, the income for the producer by the sale of ghee under the present market conditions is examined with the price spread of ghee in Tirupur area as an example :—

			Rs. A. P.
(a)	Net amount received by the producer in villages for 1-1/3 maund of butter ...		144 12 0
(b)	Proportionate charges incurred for transporting from village site to the market centre (average distance 10 miles) ...		1 4 0
(c)	Commission charges to agent ...		3 0 0
(d)	Proportionate labour and fuel charges for melting into ghee ...		1 0 0
(e)	Proportionate charges for packing the ghee...		3 0 0
	Cost of tins	Rs. 1 12 0	
	Sealing and soldering charges	,, 0 3 0	
	Label charges	,, 0 12 0	
	Cost of rope for tying	,, 0 5 0	
(f)	Wholesalers' margin of profit ...		7 0 0
(g)	Wholesale merchants. selling price or retail merchants, purchase price ...		160 0 0
(h)	Proportionate charges incurred by the retail merchant for transport of ghee to places like Madras city ...		3 4 0
(i)	Margin of profit to retailer ...		4 12 0
(j)	Retail merchants' sale price or consumers' purchase price ...		168 0 0

Thus it is seen that the producer is able to realise the full value of the milk that goes in the production of ghee, provided he finds a market for the butter milk. These enquiries show that utilisation of milk in the manufacture of ghee is economical for the producers and can be resorted to in areas where there is a surplus production of milk.

A study of the production data of milk and ghee in Coimbatore shows that there is still a large surplus of milk in the villages that can be profitably utilised by conversion into ghee and there is a great scope for increasing the output of ghee in the district. However, any scheme to increase the output of ghee should also provide facilities side by side for the disposal of buttermilk which now fetches a market only with difficulty and which is likely to act as a stumbling block in the improvement of trade in ghee.

Secondly, any scheme for increasing the output of ghee will be the location of the producing centres. A great majority of the producing centres are in isolated villages with poor transport facilities. Under the present conditions the primary factor which affects the production of ghee is the difficulty experienced in transporting the produce at frequent intervals to the assembling market, due to lack of facilities for easy transport. Hence a network of agencies for the collection and transport of ghee or butter to assembling markets at short intervals should be the primary problem to be tackled. If such an arrangement can be established it will act as an impetus to increae the production of ghee, much above the present level. Considering the prominent position the Co-operative organisations occupy in the trade in Coimbatore district they can well take up the assembling and marketing of butter or ghee and arrange for collection of ghee or butter in adequate quantities by covering a wide area and also arrange to sell the produce at quick intervals either daily or on alternate days. Such a wide organisation might not be feasible for private dealers, whose finances are limited.

The suggestion of Co-operatives functioning successfully in ghee trade can be realised if all the Co-operative societies associate themselves with the Milk Union at Coimbatore and pass on their daily collections of ghee or butter (after meeting the immediate local demands) collected from a wide area through their branch societies to the Union. The Union will thus be able to pool a large quantity of ghee or butter every day which can be

marketed easily and profitably in cities where a great demand always exists. Further, Co-operatives stepping in the ghee trade can also afford credit facilities to ghee or butter producers for purchase of milch animals etc. would stimulate an incentive to produce more ghee or butter.

If improvements on the aspects mentioned above can be pushed through the ghee trade in Coimbatore has a very bright prospects ahead.

Acknowledgments: Grateful thanks are due to Sri K. Sriraman, B. Sc. (Ag.), M. Sc., Assistant Marketing Officer, Coimbatore, for his valuable guidance and to the various ghee merchants at Coimbatore at Coimbatore for their co-operation in furnishing information.

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for January 1956

I **Cotton:** (In this Section 1 candy = 784 lb., Pothi = 280 lb.)

Cotton Stocks: Tirupur: Lint. At Tirupur the cotton market opened with a stock of 3294 candies of Cambodia and 1354 candies of Karunganni lint. Estimated arrivals include 1861 candies of Cambodia and 501 candies of Karunganni lint. Despatches from Tiruppur accounted for 3,425 candies of Cambodia and 1586 candies of Karunganni lint. Chief movements were to Travancore-Cochin State, Bombay, Andhra, Mysore, Tirunelveli, North Arcot, South Arcot, Tanjore, Tiruchirapalli, Salem, Ramanathapuram and Madrs. The month-end stock comprised of 1,730 candies of Cambodia and 266 candies of Karunganni lint.

Kapas: The kapas market at Tirupur started its activity with 5,119 pothies of Cambodia and 392 pothies Karunganni kapas. 2,061 pothis of Cambodia and 16 pothies of Karunganni kapas arrived into the market. A total of 6,122 pothies of Combodia and 204 pothies of Karunganni kapas were disposed of during the month. The market closed with a stock of 1058 pothies of Cambodia and 204 pothies of Karunganni kapas at the end of the month.

Koilpatti : Lint : The cotton market at Koilpatti opened with a stock of 483 candies of Karunganni lint and 250 candies of Uganda lint while arrivals accounted for 100 candies of Karunganni and 50 candies of Uganda. Disposals included 100 candies of Karunganni and 50 candies of Uganda thereby leaving abaut 283 candies of Karunganni and 200 candies of Uganda lint.

Kapas : There was no stock of either Karunganni or Uganda kapas.

Ramanathapuram district : The three markets of Virudhunagar, Sathur, Rajapalayam together held a stock of 1015 candies (20 Karunganni and 995 Uganda). Total arrivals in all these markets amounted to 795 candies (210 Karunganni, 260 Uganda and 325 Cambodia). Sale transactions were in the order of 230 candies of Karunganni, 265 Uganda and 295 Cambodia leaving a month-end stock of 990 Uganda and 30 Cambodia.

Kapas : No stock of 1955-56 seasons remain and fresh arrivals from the current season 1955-56 are still to commence.

South Arcot district : Kapas; Arrivals were confined to Villupuram and Panruti markets which together amounted to 7 pothies, besides a carry-over of 126 pothies of the previous month. Despatches in the month amounted to 57 pothies chiefly to Tirupur leaving a closing balance of 76 pothies at the end of the month.

Cotton prices : Lint : Tirupur : The market ruled firm during the month. Prices of Cambodia lint ranged from Rs. 831/- to Rs. 891/- per candy of 794 lb. There were no transactions in Karunganni lint.

Koilpatti : Karunganni lint opened at Rs. 760/- to Rs. 780/- per candy for the best quality and remained steady throughout the month. Second quality ruled firm and stood around Rs. 730/- to Rs. 760/- per candy. Inferior qualities of Karunganni were quoted at Rs. 650/- to Rs. 660/- per candy. Prices for Uganda lint certified quality ruled at Rs. 1,100/- while uncertified quality fetched Rs. 960 to Rs. 1,000/- per candy. There were small exports of Uganda lint to Calcutta during the month.

Ramanathapuram District : Prices of Karunganni lint first and second crop were in the range of Rs. 730/- to Rs. 781/- and Rs. 630/- to Rs. 690/- respectiveiy per candy of 784 lb. The rates for Tinny stood at Rs. 590/- to Rs. 626/- per candy. Uganda certified MU. 2 were quoted at Rs. 1,186/- per candy while uncertified Uganda were transacted at Rs. 900/- to Rs. 1,001/- per candy. Cambodia rates fluctuated from Rs. 500/- to Rs. 700/- according to quality.

Kapas: Tirupur: Karunganni and Cambodia kapas were transacted at Rs. 102-8-0 and Rs. 100-115 respectivelp per pothi of 280 lbs.

Koilpatti: No transactions.

Ramanathapuram District: Karunganni first and second crop were quoted at Rs. 93 to 104 and Rs. 75/- to Rs. 82/- respectively while Uganda and Cambodia kapas ruled in the range of Rs. 131-4-0 to Rs. 138-4-0 and Rs. 75/- to Rs. 100/- respectively.

South Arcot District: The average prices of cotton kapas marketed in this district ranged from Rs. 80-12-0 to Rs. 82-4-0 per pothi of 286 lb.

Cotton Seeds: Koilpatti: The prices of Karunganni and Uganda seeds continued to be firm. Karunganni seeds were transacted at Rs. 38/- to Rs. 40/- per pothi of 280 lb. while Uganda rates were in the range of Rs. 35/- to Rs. 37/- per pothi.

Ramanathapuram District: Price ranges of cotton seeds of different varieties are extracted below:

(Prices per pothi of 280 lb.)

Varieties		*Opening*	*Closing*
Karunganni	...	Rs. 28-14 to Rs. 39—2	Rs. 39-15
Uganda	...	Rs. 24-12 to Rs. 30-10	Rs. 30-10 to Rs. 35-11
Cambodia	...	Rs. 18—0 to Rs. 19—1	Rs. 24-13 to Rs. 27—3

II **Groundnut:** (In this section: candy = 531 lb. of kernels bag = 80 lb. of pods)

Stocks: All the markets of South Arcot opened with a total stock of 13,983 tons. Arrivals into the markets accounted for 4,646 tons while 3,952 tons were received from other districts. Imports from Andhra totalled 295 tons. The chief consumers were the crushers in the order 7,911 tons by the millers and 395 tons by the country *chekkus*. Despatches to a total of 2,518 tons to places like Madras, Salem, Coimbatore and Tanjore took place, besides 19 tons sent to Pondicherry. The stock at the month end was estimated at 13,809 tons, after deducting some wastage.

North Arcot District: Nearly 4,100 tons of groundnut kernels and 1,300 tons of pods came to the market during the month and the produce was readily disposed of as a result of keen demand. The regulated market at Vellore received 397 bags of kernels during the month.

Prices: South Arcot District: The average prices at several markets ranged from Rs. 115-2-0 to Rs. 123-8-0 per candy of 531 lb. kernels.

North Arcot District: Prices of kernels ruled around Rs. 138/- to Rs. 145/- per candy of 531 lb. and prices of pods ranged between Rs. 13/- to Rs. 15/- per bag of 80 lb.

Ramanathapuram District: The opening and closing prices of groundnut pods, kernels in different markets were as follows:

(Pods: Price per bag of 82½ lb. each)
(Kernels: Price per candy of 531 lb. each)

		Opening	*Closing*
Pods	...	Rs. 8-8-0 to Rs. 11-8-0	Rs. 10-0-0 to Rs. 12-8-0
Kernels	...	Rs. 110-0-0 to Rs. 118-0-0	Rs. 120-0-0 to Rs. 132-0-0

III **Gingelly:** (In this section bag = 168 lb.)

Stocks: South Arcot District: The market started with a carry-over stock of 881 bags. Arrivals were confined to three markets and was of the order of 761 bags. Vridhachalam alone was prominent, registering 672 bags of arrivals. 280 bags were received from other districts in the State. Country *chekku* consumed 564 bags. Despatches to other districts of Ramanathapuram and Tirunelveli accounted 768 bags. The stock with the trade was estimated at 576 bags exclusive of wastages in handling.

Prices: The average price of gingelly ranged from Rs. 41 to 48/2 per bag in this district.

IV. **Coconut and its products:** (In this section: candy = 700 lb.)

Coconut stocks (In Thousands): The particulars of stocks in the districts of Malabar and South Kanara are given below:

Name of the market		*Opening balance*	*Arrivals*	*Disposals*	*Closing balance*
Malabar district:					
1. Kozhikode	...	6,275	3,300	2,700	6,875
2. Badagara	...	304	1,432	1,224	512
3. Ponnani	...	775	675	750	700
4. Tellicherry & Dharmadam	...	713	1,032	1,055	691
South Kanara district:					
1. Mangalore	...	60	225	240	45

Prices: (a) Minimum and maximum prices of coconut as between the different markets of Malabar district ranged as follows:

(Prices per thousand)

		Minimum	*Maximum*
1.	Kozhikode ...	Rs. 85	Rs. 125
2.	Ponnani ...	„ 124	„ 127
3.	Badagara ...	„ 105	„ 145
4.	Dharmadam & Tellicherry ...	„ 100	„ 110

(b) The opening and closing prices of coconuts that prevailed in Mangalore market are furnished below: (per thousand)

Raw	Rs. 130 — 165
Dry	Rs. 160 — 210

Copra: The stock position of copra in Malabar and Mangalore is extracted below:

Name of the market	*Opening balance*	*Receipts*	*Disposals*	*Closing balance*
Malabar district (in candies)				
1. Kozhikode ...	3,525	5,560	2,200	5,825
2. Badagara ...	632	1,725	1,540	817
South Kanara district (in tons)				
1. Mangalore ...	27	214	178	63

Prices: (a) The prices of copra as between the different grades at the several Malabar markets are given below:

(*Prices/candy of 700 lb.*)

Variety	*Kozhikode*		*Badagara*	
	Minimum	Maximum	Minimum	Maximum
Office ...	Rs. 270	Rs. 280	Rs. 270	Rs. 280
Edible ...	„ 275	„ 375	„ 280	„ 300
Madras ...	„ 275	„ 305	„ 280	„ 300
Rajpur ...	„ 325	„ 335	„ 325	„ 335
Gola ...	„ 300	„ 300	„ —	„ —

(b) The prices at Mangalore market ranged between Rs. 260/- to Rs. 300/- per candy of 700 lb.

V. **Arecanut:** (In this Section, Bag = 100 lb.)

The stock particulars of arecanuts in the markets of Malabar and South Kanara districts are extracted below:

Name of the market (in bags)		*Opening balance*	*Receipts*	*Disposals*	*Closing balance*
Kozhikode	...	1,242	—	1,085	157
Palghat	...	330	80	120	290
Ponnani	...	1,700	465	665	1,500
Mangalore (in cwts)	...	4,180	28,000	17,600	15,380

Prices: (a) Prices of Arecanut *(choor)* in Palghat market of Malabar district ranged at Rs. 150/- to 164/-

(b) The price ranges of *supari* of the different varieties in the Mangalore market were as noted below:

		(Price in cwt.)	
Variety		*Minimum*	*Maximum*
Koka	...	Rs. 75	Rs. 125
Choll	...	,, 175	,, 186
Malabar Supari	...	,, 115	,, 145
Mangalore "	...	,, 130	,, 170

VI. **Tobacco:** (In this section, Candy = 500 lb.)

Stocks: The Tobacco market at Tiruppur started with an opening balance of 6282 candies of chewing and 2437 candies of cheroot tobacco. Despatches included 3385 candies of chewing and 910 candies of cheroot tobacco to places like Madural, Travangore-Cochin State, Tanjore, Palghat and Madras. The month-end stocks were estimated at 4245 candies of chewing and 250 candies of cheroot types.

(b) The prices of different varieties of tobacco for different grades are furnished below:

Variety		*I grade*	*II grade*	*III grade*
1. *Chewing Tobacco, Sun-cured:*		Rs.	Rs.	Rs.
(a) Meenampalayam	...	425 to 475	360 to 425	275 to 325
(b) Other varieties	...	290 to 350	190 to 220	120 to 150
2. Cheroot varieties sun-cured (grown in Bhavani & Erode taluks)	...	340 to 400	220 to 340	125 to 210
3. Chewing varieties pit-cured (grown in Palladam & Sulur taluks	...	250 to 290	135 to 200	110 to 135

Review of Market Conditions of Commercial Crops in the areas of Market Committees for February, 1956.

I. **Cotton:** (In this section: candy = 784 lb. pothi = 280 lb.)

Cotton Stocks: Tiruppur: Lint: The cotton market at Tiruppur started with an opening balance of 1730 cdys. of Cambodia and 266 cdys. of Karunganni lint. Estimated arrivals during the month amounted to 2382 cdys. of Cambodia and 181 cdys. of Karunganni lint which included 479 cdys. of Cambodia and 3 cdys. of Karunganni produced by ginning arrivals to the market. Despatches nuring the month accounted for 2809 cdys. of Cambodia and 145 cdys of Karunganni lint which include 1317 cdys. of lint sent to Travancore - Cochin State, Bombay, Ahmedabad, Orissa, Madras, Tiruchirapalli, South Arcot and North Arcot. There was a closing stock of 1303 cdys. of Cambodia and 302 cdys. of Karunganni lint at the end of the month.

Kapas: The kapas market at Tiruppur started with an opening balance of 1058 pothies of Cambodia and 204 pothies of Karunganni. Arrivals during the month amounted to 8465 pothies of Cambodia and 290 pothies of Karunganni kapas. Disposals in the month totalled 7170 pothies of Cambodia and 292 pothies of Karunganni, leaving a closing stock of 2353 pothies of Cambodia and 202 pothies of Karunganni.

Koilpatti; Lint: The Cotton Market at Koilpatti opened with a stock of 483 cdys. of Karunganni and 250 cdys of Uganda while arrivals in the month accounted for 50 cdys. of Karunganni alone. Disposal was of the order of 400 cdys. of Karunganni and 200 cdys. of Uganda, leaving a closing stock of 83 cdys. of Karungauni and 50 cdys. of Uganda at the month end.

There was no transaction in kapas of either Uganda or Karunganni.

Ramanathapuram: Lint: The three markets of Virudhunagar, Sathur and Rajapalayam put together opened with a stock of 1,20 cdys of lint while the arrivals during the month amounted to 325 cdys. Disposals during the month were 980 cdys leaving a closing stock of 365 cdys of all varieties at the end of the month.

Kapas: In the markets of Virudhunagar and Rajapalayam 400 pothies of kapas arrived during the month and the entire quantity was disposed of.

South Arcot District: Kapas: Arrivals were continued to Kapas only in Villupuram Market, amounting to 4 pothies. There were no despatches during the month. The closing balance of stock at the end of the month was 63 pothies.

Cotton Prices: Lint: Tirupur: The Cotton Market in this Market was very brisk during this month. The price of Cambodia lint of average variety was Rs. 850/- per cdy while that of Karunganni was Rs. 775/- per cdy.

Koilpatti: Karunganni lint opened at Rs. 760/- to Rs. 780/- for the best quality and remained steady at that level throughout the month. Second quality Karunganni fluctuated narrowly between Rs. 700/- to Rs. 730/- Inferior second crop of Karunganni cotton ruled steady around Rs. 650/- per cdy. About 200 cdys of Uganda cotton was exported to Bombay at prices ranging from Rs. 1,080/- to Rs. 1,100/- for the certified quality and Rs. 970/. to Rs. 1,000/- for the un-certified quality.

Ramanathapuram District: The opening and closing rates per candy of 784 lb. of Cotton lint in all the markets of the district ruled as follows:

		Opening:	*During:*
Karunganni	...	Rs. 626—681	Rs. 796—836
Cambodia	...	Rs. 600—700	Rs. 650—900
Tinny	...	Rs. 600	N. S.
Uganda	...	Rs. 990—1011	Rs. 986-1030

(N. S. = No Stock.)

Kapas: Tirupur: Prices of Cambodia Kapas were quoted at Rs. 115-132 per pothi of 280 lb. and Karunganni Kapas at Rs. 102-1030 per pothi in this Market.

Koilpatti: There was no transaction of kapas in this Market during the month.

Ramanathapuram District: The fresh and season crop of Karunganni kapas is quoted at Rs. 70/- to 116/- per pothi during the month.

South Arcot District: The average price of kapas in the markets of this district is quoted at Rs. 83—4—0 per pothi.

Cotton Seeds: Koilpatti: The prices of Karunganni seeds in this market are quoted at Rs. 37-39 per pothi while the prices of Uganda seeds ruled at Rs. 35/- to Rs. 37/- per pothi.

Ramanathapuram District: The opening and closing prices of cotton seeds of all varieties in all the markets of this district are quoted as follows:

(Prices per standard maund of 82 2/7 lb.)

		Opening	*Closing*
Karunganni	...	Rs. 12-0-0 to Rs. 14-8-0	Rs. 15-0-0
Cambodia	...	Rs. 8-0-0 to Rs. 9-0-0	Rs. 10-0-0 to Rs. 12-0-0
Uganda	...	Rs. 10-8-0 to Rs. 11-0-0	Rs. 13-0-0 to Rs. 13-5-0

II. **Groundnut:** (In this section: candy = 531 lb. of kernels; bag = 80 lb. of pods).

South Arcot District: All the Markets of South Arcot District opened with a stock of 13,809 tons and the arrivals during the month accounted for 1,525 tons, which included 74 tons of receipts from other States and 1,248 tons of receipts from other Districts. Consumption by oil mills and country *chekku* in the district amounted to 5,833 tons and 123 tons respectively. Despatches in the month accounted for 403 tons leaving a month and stock of 8,170 tons of groundnut kernels.

The average price of Groundnut Kernels at the several markets ranged from Rs. 118-5-0 to Rs. 136-12-0 per cdy., according to quality.

North Arcot District: Nearly 12,000 bags of kernels (bag: 177 lb.) were received in the Markets and 6,793 bags were transported to Madras, South Arcot, Salem, Erode and Coimbatore.

The prices of groundnut kernels started at Rs. 145/- per cdy. at the begining of the month, declined at Rs. 133/- and finally dropped to Rs. 125/-.

Ramanathapuram District: The opening and closing prices of groundnut pods and kernels in the markets of this district are quoted as follows:

	Opening	*Closing*
Groundnut pods per bag of 82 lb. ...	Rs. 12—13	Rs. 13—14
Groundnut kernels per cdy. ...	Rs. 130—142	Rs. 125—135

III. **Gingelly: South Arcot District:** (In this Section: Bag = 168 lb.)

Arrivals in the three markets of the district amounted to 426 bags of which 344 bags were received by Virudachalam alone. Receipts from other districts amaunted to 236 bags. Consumption of *chekkus* and despatches to other districts took away 710 bags and 181 bags respectively leaving a closing stock of 334 bags at the end of the month.

The average price in the several markets ranged from Rs. 61/- to Rs. 66/2 per bag.

IV. **Coconuts:** (In this section: Candy = 700 lb.)

Stocks (in thousands): The particulars of stocks in thedistricts of Malabar and South Kanara are extracted below:

Malabar District:	*O. B.*	*Arrivals*	*Disposals*	*C. B.*
Kozhikode ...	6,875	4,400	4,900	6,375
Badagara ...	512	1,810	1,640	682
Ponnani ...	700	2,31s	2,415	600
Tellichery & Dharmadam ...	691	1,098	1,109	680
South Kanara District:				
Mangalore ...	45	325	315	55

Prices: (a) The minimum & maximum prices of coconut as between the different markets of Malabar district ranged as follows:

		(In Rupees) *Minimum.*	*Maximum*
Kozhikode	...	110	117
Ponnani	...	100	145
Badagara	...	108	115
Tellichery & Dharmadam	...	105	130

(Prices per thousand)

(b) The opening and closing prices of coconuts in Mangalore Market are furnished below:

Raw	Rs. 135—165
Dry	Rs. 160—200

Copra: The stock position of copra in Mangalore and Malabar are extracted below:

Malabar District: (In cdys.)		*O. B.*	*Receipts*	*Disposals*	*C. B.*
Kozhikode	...	5,180	7,300	6,400	6,008
Badagara	...	817	1,930	2,150	597
South Kanara District: (In tons)					
Mangalore	...	63	232	235	60

(a) The prices of copra as between the different grades at several markets of Malabar district are furnished below:

(Prices in Rs. per cdy.)

		Kozhikode.		*Badagara.*	
		Minimum	Maximum	Minimum	Maximum
Office	...	270	275	270	270
Edible	...	285	290	285	290
Madras	...	281	300	280	300
Rajpur	...	325	330	325	330
Cola	...	300	315	—	—

(b) The prices of copra in Mangalore market ranged between Rs. 260—285 per cdy. of 700 lb.

V. **Arecanut:** (In this section: Bag=100 lb.)

Stocks: The stock particulars of arecanuts in Mangalore and Malabar markets are extracted as follows:

Malabar: (in bag of 100 lbs. each.)		*O. B.*	*Receipts*	*Disposals*	*C. B.*
Kozhikode	...	157	—	157	—
Palghat	...	293	75	90	275
Ponnani	...	1500	460	600	1,360
South Kanara District:					
Mangalore (*Supari* in cwts.)	...	15,380	39,424	33,405	21,400

Prices: (a) Prices of arecanut (*choor*) in Palghat ranged at Rs. 158/- to Rs. 165/- per bag of 100 lb. each.

(b) The price ranges of *supari* in Mangalore market in the different varieties are noted below:

Variety		*Minimum*	*Maximum*
Kokal	...	75	120
Choll	...	165	195
Malabar Supari	...	115	145
Mangalore Supari	...	140	167

IV. **Tobacco:** (In this section: candy = 500 lb.)

Stocks: The tobacco market at Tirupur opened with a stock of 4,245 cdys. of chewing and 250 cdys. of cheroot varieties. Despatches included 1,480 cdys. of chewing and 94 cdys. of cheroot varieties to places like Palghat, Malabar, Ramnad, Tanjore, Vedaranyam, North Arcot District, Madras and Travancore Cochin State. The month-end stock is estimated at 3,058 cdys. of chewing and 460 cdys. of cheroot tobacco.

Prices: The prices of different varieties of tobacco for different grades ruled at ranges furnished below:

(Prices in Rupees per cdy. of 500 lb.)

Variety		*I grade*	*II grade*	*III grade*
1. *Chewing, tobacco sun-cured:*				
(a) Meenambalayam	...	400—450	300—375	200—250
(b) Other varieties	...	280—335	190—225	110—150
2. Cheroot varieties sun-cured (grown in Erode and Bhavani taluks).	...	350—450	250—350	140—200
3. Chewing varieties (pit-cured (grown in Palladam and Sulur taluks).	...	250—275	200—250	100—150

Review of the Activities of the Market Committees during February 1956

All the Market Committees continued to function during the month. Except the Coimbatore Market Committee which is working under an elected body all the other Market Committees are in charge of their respective Collectors or his nominees under Section 6A of the Madras Commercial Crops Markets Act. Necessary steps are being taken for the conduct of fresh elections for these Committees.

The following progress was made by all Market Committees in the matter of issue of licenses under the provisions of the Madras Commercial Crops Markets Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	166	339	145	289	82	144	—	—
South Arcot Market Committee	280	714	261	671	237	618	—	—
Coimbatore Market Committee	87	115	99	195	77	178	—	3
Tirunelveli Market Committee	2	3	—	1	—	—	—	—
Ramanathapuram Market Committee	1	3	—	3	—	—	—	—
Malabar Market Committee	57	194	316	748	22	138	—	3
South Canara Market Committee	31	117	20	97	8	42	—	—

A : During the month. B : Upto the month from January 1956.

The total volume of transactions in commercial crops in all the regulated markets in the State during February 1956, is extracted below:

Crop		Quantity	No. of regulated markets
Groundnut kernels	..	2,248 tons	10
Gingelly	..	445 bags of 168 lb. each	1
Cotton kapas	..	7,039 pothies of 280 lb. each	2
Coconut / Arecanut	..	Nil	

II **Meetings:** No meetings were conducted in any of the Market Committees during the month.

III. **Quality appraisal:** 363 samples of groundnut kernels drawn from 3796 lots comprising of 24536 bags of 177 lb. each in six markets of South Arcot Market Committee and were analysed for quality factors.

Total Common refraction was below 4% in 219 samples, between 4 to 8% in 119 samples and above 8% in 25 samples. The details of analysis are extracted below:

Particulars	Cudda-lore	Villu-puram	Tindi-vanam	Viruudha-chalam	Panrut	Kalla-kurichi
1. *Dryage:*						
2% and below ..	5	—	1	59	2	6
above 2% and upto 3% ..	9	—	—	13	1	1
above 3% and upto 4% ..	9	—	2	7	14	11
above 4% and upto 5% ..	4	2	8	3	6	23
above 5% and upto 10% ..	31	5	28	—	60	22
above 10% ..	11	5	2	—	13	—
2. *Total refraction:*						
4% and below ..	4	—	33	52	95	34
above 4% and upto 8% ,.	47	10	8	30	—	24
abcve 8% ..	18	2	—	—	—	5

Marketing Notes: On 25—1—1956 the prize distribution ceremony of summer quality competition for Kallakurichi and Chinnasalem jurisdiction was held under the presidency of Sri P. Rathnaswamy, Block Development Officer of Chinnasalem. A large gathering of ryots and traders were present on the occasion.

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Editorial

Is Language a Vehicle or Barrier to Science? The one-world concept of Wendell Wilkie is still a far-off ideal and present day trends do not encourage any likelihood of speedy improvement, although stray examples like the F. A. O., with its solid, though unspectacular record of useful work and the recent International Conference at Geneva on the peaceful uses of nuclear energy might mitigate our pessimism to a slight degree.

The value of things is seldom proportionate to their size. The contribution to science of any country or linguistic group is not in proportion to its size, for instance, in spite of the fact that England is after all only a small island in a corner of the continent of Europe, the majority of present-day scientific work is published only in English. It is estimated that nearly fifty per cent of the world's scientific work is written in English, about fifteen per cent in French and German, perhaps ten per cent in Russian, and two to three per cent in Spanish, while the remaining seven to eight per cent includes all the other languages of the world. In future years it is likely that the importance of Russian and Japanese might increase and possibly Chinese too may come to assume more importance, but it is very unlikely that any language in India or Pakistan would ever emerge as capable of replacing English as a medium of scientific communication.

It follows therefore that a nation using a language which from the global viewpoint is only a "minority language" can never avoid the need to learn two languages, if it aspires to attain a high level of scientific achievement. In this context we have also to recognise that however strong

local and linguistic patriotism might be, equally strong is the desire of the scientific worker to publish his work in periodicals that are likely to be read by his scientific colleagues, whatever be their race or tongue.

A further brake upon excessive linguism is finance. In almost every country where the language is only one of the minor tongues of the scientific world, economic resources would be very limited and will not permit of being spent on ventures that can only pander to local vanities. Another limitation would be the very negligible overseas demand for such parochial periodicals on scientific subjects. Even as it is, very few libraries can afford to subscribe to all the scientific periodicals and publications they would like to have, so that they are compelled to be very severely selective in their choice. And then we have the scientific workers' difficulty of keeping abreast of current progress in different branches of science. Even now there is an urgent need to counteract undue specialisation, by concentrating publication in only a few periodicals, in languages that are most widely understood. From this point, one universal language would be most desirable, but unfortunately this is not a feasible idea at the moment. The utmost that can be hoped for at present is to have a world-wide organisation to make available translations or at least summaries of the most important papers concentrating upon major periodicals – as that would in turn encourage the scientist to publish his results in the most widely-read journals. The second need is to have a world list, complete and without any overlapping, of all books and papers published. The third need is to provide translations of any useful paper cheaply and quickly. It is no doubt true that a beginning has already been made in these directions by the Abstracting Board of the International Council of Scientific Unions, but what is really needed is a clearer appreciation of the paramount importance of free communication of ideas and information and the incompatibility of real scientific progress with nationalism – which often deteriorates into parochialism.

Science for the Farmer—III
Have we the Herbage Species?

by

R. M. SAVUR, I. E. S. (Retd.)

No country can take wiser action in the interests of the health and stamina of its people than to ensure that its children do not suffer for want of milk. This is just what our Governments are making frantic efforts to do, to ensure that our children do not want for milk. But so far all their measures are concerned only with improving the breed of our cattle, by providing more and better breeding bulls, artificial insemination, etc. But all seem to ignore the fact that the effect of better sires can easily be nullified by poor feeding. The improvement in the calves produced can be maintained only if they are fed with nutritious feeds and fodder in larger quantities than we have been finding it possible to give their mothers.

The Dutch Friesian breed was believed to be the heaviest milkers in the World. British breeders took Friesian cattle to England and so improved them that now the British Friesians are recognised as an almost distinct breed superior even to the Dutch Friesians. Breeders of this calibre, we are told, have a saying that "half the pedigree goes in at the mouth." *Pari passu* with measures to supply pedigree sires we must take steps to provide better feeds and fodders and in larger quantities, or all our efforts will be wasted.

In England and Wales in 1946 more than thirteen million acres were under permanent grass and temporary leys of cultivated grass, with an additional acreage of over two hundred thousand acres cropped with beans and peas for stock feed as against ten and a half million acres under grain and other crops. This is because Britain, being a Welfare State, prefers; in the interests of national health and economy, to produce all its requirements of liquid milk and to import foodgrains to meet its deficit in them. Fortunately for us we can aim at self-sufficiency in both liquid milk and foodgrains, for we have vast areas of cultivable waste land for grass production. Further, our acre yields of foodgrains are so low that with scientific methods we could double our production using less arable land than at present. So in this country it is quite possible to achieve self-sufficiency in both milk and foodgrains but

whether this is probable will depend entirely on the kind of lead our newly started extension services are going to give us farmers.

The main principles of growing forage crope and grass which are fundamental to sound farming practice are the same all over the World, but the environmental conditions in the tropics are so different from those in temperate climates that it is not feasible to put these principles into practice exactly on the lines that experience has proved to be advantageous in the United Kingdom. For instance, perennial legumes, like lucerne and the clovers of temperate climates will not thrive so well in the tropics and so far scientists in the tropics have failed to find a legume that will effectively take their place in the rotation. Scientific knowledge and research on the problem of grassland management in the tropics is still in its infancy. Such research in this country is essential, for in the words of Dr. J. B. Pole Evans: "Pastoral research, if given full scope, holds the key to the preservation of our water and soil resources, the raising of our soil fertility, the revitalisation of our agriculture, the termination of the drift from country to town, the production of more wholesome food, the creation of a more healthy people and a more contented and vigorous nation."

Attempts to grow grass, however need not wait for the results of such research, for there is enough information available, about suitable grasses for every kind of environment. Such information as is available proves that we have in this country the grass species fit for cultivation and all that the farmer need do is by actual trial choose the species, variety and strain best suited to his environment. We can proceed with confidence to make our trials and cultivate grass because we have one advantage which more than compensates for the absence of perennial legumes and the superior nutritional value of the grasses of the temperate climates. The average yield of green forage from cultivated tropical grasses will be several times that which is usually obtained from a good grass ley in England and the total yield per acre of digestible nutrients will be considerably more than is obtainable from pasturage in temperate regions with their shorter growing season and winter frosts. The protein content of tropical grasses can easily be raised to the level of the average pasture grasses of temperate regions by two simple measures well within the capacity of any farmer. One is better manuring of the forage crop. The second is the growing of grasses under the shade of leguminous trees

because this has been found to increase the total yield of grasses grown under shade as well as the percentage of protein. In fact figures quoted in books of unquestionable authority seem to show that by growing a good tropical grass under leguminous shade, combined with good cultural treatment the protein content can be raised so as to equal, if not excel, the percentage of protein in the best temperate grasses. In support are these figures taken from Joint Publication No. 10 of the Commonwealth Agricultural Bureaux and the F. A. O. study: "Improving the world's grasslands."

Carpet or sannah grass grown under legume shade	Protein content–14%
Very good (English) meadow hay	10. 0%
Young crested wheat grass (of temperate regions)	10. 15%

From the practical farmer's point of view forage species can be divided into two classes :–

(1) Forage crops of little or no value for building up soil structure.

(2) Species which have high feeding value as well as capacity for soil aggregation.

The farmer's job is to fit both these into his farming system so as to get highest return from his land while building up its fertility and maintaining it at the highest level possible.

Under each of the above classes will be mentioned only those species which have been tried and found to grow luxuriantly on the West Coast climate on the alluvial sands of the coastal strip. These will be enongh to prove that we have the species.

Class 1.

Seasonal Forage Crops which do not affect soil aggregation; The sorghum species are nutritious forage crops which are quick-growing and yield a heavy tonnage of green forage. Of these the best for fodder is some sweet sorghum variety. Sown with the first pre-monsoon showers towards the end of May, on well-drained soil one can get two heavy cuttings by the end of October, when the dry weather kills the stubble. Usually the sweet sorghum varieties are useless for grain purposes but a variety which I brought from Wardha bears excellent ear-heads of large white

grains and its grain yield on my farm was, last season, better than the best I have obtained from the improved Coimbatore dual-purpose strains like CO. 11.

Closely allied to these cultivated sorghums there are some grass sorghums whose seed is of no value except for sowing. Of these the only important species is Sudan grass. Curiously enough Sudan grass is unimportant in Sudan itself but is greatly valued in the U. S. where it was introduced from Khartoum in 1909 and met with immediate success. We are told that from the eight ounces of seed originally imported in 1909, a crop was developed that in 1918 was worth 10,500,000 dollars. I have tried and found Sudan grass eminently suited to these well-drained but poor, sandy soils. It makes excellent hay and can also be used for silage. It can be cut and fed as green forage or grazed. On the West Coast, when sown with the pre-monsoon showers it yields at least three cuttings and sometimes four, if there are showers in November-December. Under irrigation it will live for more than a year and give six to eight cuttings depending on the manuring. It makes very rapid growth from seed and tillers profusely, the tillering being favoured by mowing. Its quick growth makes it very well adapted for use as a catch crop for hay or silage. In the U. S. the yield is stated to be over three tons of cured hay per acre. At the University Farm at Honolulu the total annual yield from eight cuttings was reported to be 49 tons an acre of green forage. When you add to all this the fact that tests at the University Farm showed that Sudan grass was the only one of several grasses (including Napier, Guinea, and Rhodes grasses) that gave significantly higher milk production you can imagine its potential value to the mixed farmer of the West Coast who has an acre or two of waste land that he does not know how to use.

In the U. S. they have developed a variety called Sweet Sudan by crossing a saccharine sorghum with Sudan grass which is said to be even better than Sudan grass, because it is more palatable, has broader leaves, larger stems and taller growth than the ordinary Sudan grass and matures later.

In spite of the potentialities of Sudan grass we are not likely to be able to get seed to enable us to grow it on any scale. Fortunately for our immediate needs we have substitutes which are not inferior to it. It seems that according to chemical analyses *Setaria italica (Tenai)* is about as nutritious as Sudan grass and Timothy, which

is by far the most extensively grown hay grass in the U. S. *Setaria italica* does better than sorghum on poor soils and stands heavy rains better. It can therefore be sown later than cholam, even when the monsoon is beginning in right earnest. Another forage crop which is not exacting in its soil and fertility requirements is *Pennisetum typhoides (Cumbu)*. The seeds of both these are cheap and only a few pounds are required to sow an acre. But in the case of *Cumbu* there is a special fodder variety which tillers profusely and can be cut repeatedly. This fodder variety should be used in preference if a purely forage crop is desired.

Both the total yield of forage and its protein content can be enormously increased by growing some legumes in association with the above-mentioned cereals. At the same time the legume roots and stubble will more than replenish the soil nitrogen used up by the forage crop. I have found two annual legumes pre-eminently suited to these poor soils. In areas which are not water-logged, cow-pea and velvet bean do well in the poorest of soils provided they contain legume nodule bacteria. On land on which legumes have never been grown it is advisable to use inoculated seed for the first sowing. This culture can be obtained from the Coimbatore Agricultural Institute and costs nothing.

I smiled a superior smile when I read that the Sudanese were so ignorant of the value of Sudan grass that they never attempted to cultivate it. But believe me, I did not feel amused and ceased to feel superior when I read about velvet bean. What I read was this :–

"The velvet been is apparently a native of India. It is said to have been introduced into Florida nearly a century ago. It was grown as an ornamental vine for porches and trellises. The velvet bean has been an important factor in the development of the live-stock industry and as a soil-improving crop. The seeds have a high feeding value and are important as a concentrated feed; the leaves and vines afford good roughage. For soil improvement, especially on sandy soils, the velvet bean is one of the best crops."

There is not the least exaggeration in the above quotation for I have been growing velvet bean for more than four years and I know. But how many fellow-countrymen of mine grow this valuable native of India ?

Cowpea likes warm weather, will stand considerable drought and tolerates shade. It is better adapted to varied soils and makes better growth under adverse conditions than most other legumes. In the U. S. it is considered so valuable a crop for human consumption as well as for hay and silage, that the annual acreage under cowpea is some three million acres. Cowpea hay analysis, on the average show a little over 16 percent of protein; mixing cowpea hay with even paddy straw would provide a maintenance ration sufficiently nutritious for our indigenous cattle to justify cutting out expenditure on cakes. I am putting into practice my conviction that in velvet bean and cowpea we have two of the finest legumes for improving poor soils and poor cattle, not to mention poor farmers as well.

Research Notes

A note on Sweet Sudan Grass

There have been frequent enquiries by a number of interested farmers as to what exactly 'Sweet Sudan' is. These enquiries have been prompted by the high praise this fodder grass has received in foreign journals and press communications. Sweet Sudan grass U. S. A. Reg. No. 92 was obtained by workers at the Texas Agricultural Experiment Station in co-operation with the U. S. Department of Agriculture. The common Sudan grass has insipid stems and to improve this important fodder grass it was crossed with a sweet-stemmed grain sorghum variety 'Leoti Sorgo'. The hybrid was crossed back to Sudan grass. Some of the plants from the progeny which were highly palatable to cattle were inter-crossed, and from the progeny suitable plants were selected. The mixture of strains has been named as 'Sweet Sudan'. The following characteristics of the plant has been extracted: (Agronomy Journal Vol. 41, 1949–page 539).

"Sweet Sudan grass is a strain that resembles the common variety but has stems that are slightly coarser, and are juicy and sweet, rather than pithy. It is slightly later in maturity, has tan plant colour, and has glumes that are sienna in colour rather than straw to black." "The desirable characteristics of Leoti Sorgo that have been incorporated into Sweet Sudan grass are: juiciness and sweetness of stem; some resistance to foliage diseases, to chinch bug and charcoal rot; sienna glume colour that allows a mechanical mixture with Johnson grass to be easily detected; high seed-producing ability; and less shattering. Sweet Sudan grass grows more slowly in the early spring than does common sudan grass but

remains green and growing and more palatable later in summer and fall. A mixture of strains was distributed rather than a pureline because no pure line was found that was a vigorous as first generation hybrids whose parents were different strains. Since the cross-pollination percentage in Sudan grass in frequently 50 or more, it was thought that a mixture of purelines would soon result in a synthetic variety that would soon become homozygous and contain enough heterozygous plants to raise the average production and vigor of the variety considerably".

At the Agricultural College and Research Institute, Coimbatore, hybridizations have been done between Sudan Grass and one of the recommended fodder types namely, Co. 11. Cholam Co. 11 is a strain having juicy and sweet stalks which is now spreading in all the districts. It yields about 25,000 lb. of succulent sweet green fodder per acre, in about 70 days when grown under irrigation. The selections from this hybridization would yield fodder types which may be drought-resistant also and thus give plants which may demand less water.

Another series of hybridisations is at hand in which the hybrid between the grain Sorghum and Johnson grass is inter-crossed with several other types like (i) Co. 11, a fodder strain of cholam (ii) low HCN content Sudan grass to evolve a fodder strain with less of HCN content, (iii) Leoti Sorgo, a sweet juicy-stemmed grain sorghum from America and (iv) A. S. 4003 a cholam variety from Africa resistant to the parasite Striga in order to select out different types of fodder sorghum strains.

Agriculture Research Institute,
Coimbatore, 17—3—1956.

N. KRISHNASWAMY.

A Note on Heavy Manuring of Rice at The Agricultural Research Station, Aduthurai

Experiments to determine the optimum dose of manure for rice were conducted at the Agricultural Research Station, Aduthurai in previous years, as a result of which a manurial schedule of 5000 lb. of superphosphate, is being adopted at the station and also recommended to cultivators to get maximum economic returns. The present note deals with observations on a bulk trial conducted during 1954 in *Kuruvai* (June-September), *Samba* (July-January) and *Thaladi* (September-February) seasons, to find out how far the yield could be increased without reference to margin of profit, by heavy dosages of manures in comparison with the doses usually adopted. The details of the trials are furnished below.

Two contiguous plots in the same block, each 40 cents in area were selected, of which one field received heavy manuring as detailed below.

A. *Heavy manuring per acre:*

6000 lb. green leaf (30 lb. Nitrogen)
10 cartloads cattle manure (50 lb. Nitrogen)
350 lb. Ammonium Sulphate (70 lb. Nitrogen)
150 lb. Super phosphate (25 lb. P_2O_5)

Total Nitrogen	150 lb.
Total P_2O_5	25 lb.

B. *Normal manuring per acre:*

5000 lb. green leaf (25 lb. Nitrogen)
150 lb. Ammonium Sulphate (30 lb. Nitrogen)
150 lb. Super phosphate (25 lb. P_2O_5)

Total Nitrogen	25 lb.
Total P_2O_5	25 lb.

Green leaf and cattle manure were applied well in advance of planting and superphosphate at the time of final puddling and levelling of the plots. Ammonium sulphate was applied in split doses to supply 35 lb. nitrogen at planting and 35 lb. nitrogen a month before flowering in the case of heavy manuring (A) and 20 lb. nitrogen and 10 lb. nitrogen correspondingly, under nomal manuring (B). Variety ADT. 20 (105 days) was grown in *Kuruvai* season, Co. 25 (185 days) in *Samba* season and ADT. 25 (165 days) in *Thaladt* season. As is the usual practice, in *Kuruvai* season the seedlings were planted with a spacing of 4″×4″ while in the other two seasons it was 6″×6″.

One hundred plants were taken at random for counts of productive tillers and measurement of height, length of panicle and proportion of of grain and chaff. The gross yield also was taken from which acre-yields were calculated. The data collected during the three seasons are furnished in the table.

Field observations showed that the crop under heavy manuring had better growth with darker green foliage than that receiving normal manuring. Lodging was seen in the crop under heavy manuring in all seasons, particularly so in *Samba* and *Thaladi.* The *Samba* and *Thaladi* varieties had a longer vegetative phase and so grew taller and lodged even before blooming.

From the data presented it will be seen that although the number of earbearing tillers is more under heavy manuring, the difference between lengths of panicle is negligible. The proportion of chaff to grain is higher in heavily manured plots in all cases; it is highest in the short-duration *Kuruvai* crop.

An extra yield of 275 lb. is obtained from *Kuruvai* crop under heavy manuring, but the value is not commensurate with the extra expenditure involved. In the other two seasons there is an actual reduction of yield, due to lodging and consequent non-set spikelets.

The results that the advantage of heavy manuring can be realised only if a non-lodging variety is grown. Whether or not a heavier dose of superphosphate (under heavy manuring) would reduce the lodging, is a factor to be considered. In spite of a larger proportion of chaff, the *Kuruvai* crop under heavy manuring has recorded high yields. This may be attributed to the closer spacing adopted and consequent increase in the number of plants per unit area. Manuring beyond an optimum dose is decidedly uneconomical. Other conditions being equal, spacing would also appear to be one of the factors influencing yield in *Kuruvai* (short duration) varieties.

Particulars	Kuruvai (ADT. 20)		Thaladi (ADT. 25)		Samba (ADT. 25)	
	Intensive manuring	Normal manuring	Intensive manuring	Normal manuring	Intensive manuring	Normal manuring
Height of plant (Mean of 100 plants) ..	3' 6"	3' 5"	4' 5"	4' 3"	5' 2"	5' 0"
No. of ear-bearing tillers (Mean of 100 plants) ..	5·2	4·6	6·6	6·0	5·4	5·2
Length of panicle (Mean of 100 ears) ..	20·3 cm.	20·2 cm.	23·5 cm.	23·3 cm.	22·8 cm.	22· 3cm.
No. of grains per ear (Mean of 100 ears) ..	66	77	142	141	178	173
No. of chaff per ear (Mean of 100 ears) ..	15	10	22	18	32	20
Percentage of chaff (unsetting) ..	18·4	11·2	13·4	11·3	15·2	10·4
No. of plants per unit area (one square foot) ..	9		4		4	
Yield of grain per acre ..	2993 lb.	2718 lb.	2537 lb.	2637 lb.	3200 lb.	3592 lb.
Extra expenditure per acre (By intensive manuring) ..	Rs. 49—2—0		Rs. 49—2—0		Rs. 49—2—0	
Extra income per acre Do. ..	Rs. 29-15—0		nil		nil	
Net loss per acre Do. ..	Rs. 19—3—0		Rs. 59—9—9		Rs. 90—3—6	

Note:— *Kuruvai* paddy is valued at Rs. 13—8—0 per bag of 124 lb.
Thaladi and *Samba* paddy valued at Rs. 13—0—0 per bag of 124 lb.

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Selected Article

Can Black Heart of Pineapples be avoided?

by

R. C. CANNON, F. W. BERRILL & K. KING

Black Heart, a physiological breakdown in the flesh of the maturing pineapple fruit, is responsible for losses each winter both at canneries and in the fresh fruit markets. The extent of these losses varies from year to year and has been considerable in some seasons, notably 1954 and 1955.

The problem: Although this disorder has been studied over a fairly long period, the precise cause of the breakdown is still not definitely established. It is certainly associated in some way with winter conditions. Losses are greatest during the months of July and August, though outbreaks sometimes occur as early as June and may continue into September. As there appears to be little prospect of preventing outbreaks of black heart, the alternative is to eliminate, as far as possible, cropping during the July – August period.

Cropping periods: Although pineapples flower and mature fruit at all times of the year, there are two major cropping periods in Queensland, summer and winter. As a general rule, the ratoon crop, at least in southern Queensland, is harvested about 18 months after the plant crop. Thus a summer plant crop is followed by a winter ratoon crop in the ordinary course of events. A plantation which produces a winter plant crop takes longer to produce its ratoon, and more often than not this crop is also harvested in winter.

Except in very abnormal seasons, a summer plant crop can be assured by efficient management. This entails planting at the correct time, the use of suitable planting material and good cultural treatment during the growing period. Provided growth is satisfactory, natural flowering for a summer crop will usually take place. If necessary, however, flower induction treatment can be applied to prevent "holding over" in plants which do not flower naturally.

Controlling the Ratoon Crop: When the plant crop is produced in summer, it is sometimes possible to harvest the ratoon crop in the following summer by making use of flower induction. However, unless the plants are well advanced and encounter favourable growing conditions, a large proportion of fruit may be undersized. A system of crop management based on the production of two successive summer crops is, therefore not generally desirable.

Two other possibilities merit consideration. These are:— (1) Advancing the plant crop by means of artificial flower induction

with acetylene or ANA solutions so that the fruit can be harvested in the January – February instead of the February – March period. Sucker growth would then be more forward prior to winter, thereby improving the chances of obtaining sizeable fruit from the ratoon crop in the following summer and autumn. (2) Harvesting the plant crop at the normal time (February – March) and forcing the growth of the suckers for an autumn crop some 15 months later.

A combination of these two methods may prove the best solution to the problem of obtaining maximum yields in the minimum time and the elimination of July – August cropping. The real problem is how to provide the extra stimulation to sucker growth for the ratoon crop. Irrigation would be an advantage, but the requisite facilities are rarely available on existing pineapple farms in Queensland. On the other hand, adequate and correctly timed fertilizer application may be sufficient to produce the desired result.

These general objectives are tantamount to restricting harvesting in the pineapple crop to the summer – autumn period of the year. Provided this did not accentuate the summer peak, there should be no undue strain on cannery facilities, and the concentration of the main harvest into six months of the year may prove an advantage.

Crop management along these lines implies precise planting programmes, efficient cultural practices and the artificial control of flowering and fruiting.

Planting: Under Queensland conditions, the cold winter and comparatively dry spring tend to check plant growth in the pineapple plantation. The adjustment of planting to control cropping is therefore not so simple as it would be in more equable climates where seasonal effects are less pronounced.

Seasonal Planting: In Queensland there are essentially two planting seasons, namely autumn and spring. Pineapples will grow at any period of the year but the behaviour of out - of season plantings rarely conforms to the requirements of a crop management system designed to control the crop.

The performance of different types of planting material under average conditions is well known. This knowledge can be utilised to assist in the control of cropping, but has to take account of differences in locality and aspect which influence the rate of growth. Some allowance has also to be made for the fairly wide seasonal variations which are characteristic of our climate and no system can be entirely reliable.

Tops, slips and suckers are the most commonly used types of planting material. The behaviour of butt plantings is rather less

predictable, and they are of doubtful value where precise timing of the harvesting period is required.

Top Plantings: The planting of summer tops has many advantages, particularly in terms of uniform plant growth and cropping. Summer tops are planted in autumn and in all but colder localities can be expected to produce a summer crop within two years of planting. To achieve this, planting should be completed before the end of March. In very favourable seasons later plantings may succeed, but more often than not, growth is barely sufficient for the production of a profitable summer crop. On account of their greater reserves of plant foods, large tops are preferred as planting material.

The scope of early planting of summer tops is limited by the time the crop from which they are obtained is harvested. Advancing the summer plant crop by even one month would provide ample supplies of tops for planting.

There are some risks associated with autumn planting of tops, for the disease known as top rot can cause quite appreciable plant losses, particularly in a wet season. Being low-set in the ground, the hearts are exposed to infection from the soil; hence the importance of having the land well prepared with a minimum of surface irregularities.

Slip and Sucker Plantings: Slips and suckers planted in the spring, given reasonably good growing conditions, will normally crop in the summer 18 months from planting. Here also, size (particularly of slips) is important, and the larger the plants used, the better the prospect of producing a good summer plant crop.

Suckers should be reasonably large but not old, otherwise they are liable to flower prematurely and produce worthless fruit. There is reason to believe that long-term storage before planting tends to increase the amount of premature flowering; hence it is preferable to collect and prepare suckers shortly before planting begins.

As Spring in southern Queensland is usually fairly dry with occasional storm rains, sucker plantings often take some time to become established. Removal of the basal leaves to expose the young roots promotes early establishment, but this is a time-consuming operation and few growers practise it. Peeling is probably not important in a season with good spring rains when the basal leaves rot fairly quickly, but in a dry season the extra work entailed would probably pay dividends.

Cultural Practices: As mentioned above, blackheart may be avoided by producing the ratoon crop before the July-August period. Much can be done by the use of good, vigorous planting material, and planting at the right time, but these alone are not sufficient. Sound

cultural practices which will maintain maximum growth from planting onwards are essential, and particular attention must be given to the selection of land for the crop, its preparation for planting, fertilising practices and weed control.

Choice and Selection of Land: The growth and survival of the pineapple root system is determined by the physical condition of the soil in which the crop is grown and even temporarily defective drainage can have an adverse effect. However, the grower has to make the best use of what land is available. Where the soil is shallow and overlies a clay subsoil, ways and means of improving the drainage have to be considered. There is good reason to believe that "ripping" improves sub-surface drainage, at least in soil types where the subsoil is not a stiff clay. In shallow soils it is also an advantage to form the land into broad beds with inter-row drains.

In preparing land for planting, the soil should be brought to a good tilth with a minimum of surface irregularities which tend to collect water on the surface and provide conditions favourable for top rot infection.

Surface mulching with sawdust, begasee and similar materials is sometimes used to conserve soil moisture during dry periods. This practice, though frequently beneficial, is somewhat risky, particularly in damp locations, since it may hold too much moisture in the soil during the wet season. Under wet conditions, a surface mulch can actually increase the incidence of top rot and root rot wilt. During the winter, a surface mulch is also liable to increase the risk of injury from chilling. These points should be taken into account when deciding whether or not a heavy surface mulch should be applied.

Fertilising: Good growth in the plantation cannot be expected without an adequate supply of plant foods. This means that the pineapple crop must receive sufficient of the right fertilisers at the right time. The pineapple is a relatively heavy feeder and requires about one ton of fertilizer per acre per year for good growth and maximum yields. Fertilizer is costly but it is false economy to reduce the amounts used below the requirements of the crop.

Pineapples require very little phosphorus but need considerable amounts of both nitrogen and potassium. Owing to the removal of soluble nutrients by leaching during periods of heavy rain, it is necessary to make several applications of fertilizer each year. The usual practice is to apply alternately a 10–6–10 mixture and straight sulphate of ammonia. This procedure is satisfactory on many soils in the more important pineapple growing areas, but some modification is needed on certain areas. For instance, the sandy soils are, for the most part, so deficient in

potassium that the above schedule provides insufficient of this element. In such cases the better procedure would be to double the amount of potassium applied by using a 10-6-10 mixture for each application. This will increase yields and could mean the difference between an early and a late summer crop.

Timing of fertilizer applications is more important than is sometimes imagined. For instance, a pre-winter dressing of fertilizer, if applied late, may be of little benefit since plants which are virtually dormant cannot make effective use of plant nutrients. For good growth in spring, it is essential that adequate supplies of nutrients be available immediately growth is resumed after the winter, and an early spring application is desirable. The usual practice is to make four applications each year – early March, early May, September, and December – January. This is the basic practice, but more frequent and lighter dressings would probably be advantageous were it not for the extra labour entailed.

High nitrogen just prior to flowering may promote excessive vegetative growth and delay natural flowering or make artificial flower induction very difficult. For this reason, it is inadvisable to apply a heavy dressing of nitrogenous fertilizer at this time. After flowering has taken place the position is quite different, for during the period of fruit development the plant requires a great deal of nitrogen and any shortage could be reflected in reduced fruit size. Similarly, an adequate supply of nitrogen is needed immediately after the summer crop has been harvested; the liberal use of nitrogenous fertilizers at this time might well determine whether or not the ratoon suckers will be sufficiently advanced to produce a May – June crop.

Weed Control: Weeds in the plantation can greatly retard the growth of pineapple plants, particularly in dry periods when soil moisture is limited. From planting onwards throughout the cropping cycle, complete freedom from weeds of any size is most important.

Weeds soon get out of hand if proper attention is not given to spray schedules and growth of the pineapples suffers. Too much emphasis cannot be given to the advantages of pre-germination PCP sprays as against the contact sprays used to deal with established weeds.

Artificial Flower Induction: Given favourable treatment and a reasonably good season, a summer plant crop of fruit can be expected, even without the aid of artificial flower induction. However, this is a valuable means of ensuring that a well grown crop does not "hold-over" and upset planned cropping. Following a summer plant crop, only a limited proportion of the first ratoon plants will flower naturally and produce a crop before winter. To achieve prewinter cropping over

the whole area, therefore, it is not only necessary to promote maximum growth in the ratoon suckers, artificial flower induction is also imperative.

In central and northern Queensland where temperatures generally are rather more favourable for plant growth, a summer or autumn ratoon crop is more readily attainable following a summer plant crop.

Normal Plant Crop: The normal summer crop in southern Queensland is usually harvested from late January to March, but the period is variable depending on the district and the particular aspect of the plantation. In some of the colder areas, harvesting may not be completed until late in April. Suckers on a plant which matures its fruit in January are usually considerably more advanced by the onset of winter than those produced following a March crop.

To ensure uniform flowering in a given area for a summer crop, flower induction treatment may be applied in the preceding May. The value of this practice is now generally recognised, but some growers are reluctant to adopt it because they fear that poor suckering and generally reduced vigour will follow treatment. This fear is based on wrong premises, for if a plant is sufficiently well grown at the time of flowering, it will produce a normal complement of vigorous suckers, as well as a good-sized fruit, irrespective of whether the flowering process occurs naturally or is initiated artificially.

Time of flowering influences the amount of suckering and even a well-grown plant may not sucker satisfactorily if forced to flower out of season. An under-sized plant, on the other hand can be induced to flower but will invariably produce a small fruit and few, if any, suckers. Experience will indicate the minimum size at which plant can be safely treated, but, as a guide, unless the largest leaves are 30 inches or more in length a grower should hesitate to induce flowering.

Advancing the Plant Crop: As the aim is to produce a first ratoon crop earlier than usual to avoid harvesting in the winter period advancing the plant crop would be an advantage. Since climatic conditions become increasingly less favourable for growth as the winter approaches, an advance of only a few weeks in the time of maturity of the plant crop could easily increase the size of the ratoon suckers before winter.

The use of artificial flower induction treatment in May has been advocated for some time as a means of ensuring uniformity in flowering for the normal summer crop. Where it is desired to induce earlier bearing it would be necessary to correspondingly advance the time of treatment. April treatment would in many areas have the desired effect. Advancing the time of treatment excessively is undesirable owing to the likelihood of producing a "prickly-eye" type of fruit in the Christmas period.

In cool districts, where the summer crop normally does not mature until well into the autumn, it is probably impracticable to attempt to advance flowering. In such areas the normal winter ratoon crop would be so much later that it would automatically escape the critical black-heart period.

Spreading the Harvest: While uniform flowering is an advantage from many points of view there may be circumstances where concentration of the harvest in a limited period may overtax the labour force for a short time. The position may be relieved to some extent by treating the developing fruit with a high concentration of ANA, which will increase weight and slightly delay maturity. This treatment applied to portions of a cropping area would be an advantage in such cases, and the delay of about 10 days in harvesting would not be of great consequence, particularly where the crop had already been advanced by early flower induction treatment.

The above discussion of black heart in the winter pineapple crop indicates that the problem in southern Queensland may be solved by means of crop management practices designed to eliminate harvesting during the critical months of July and August.

[From the Agri. Gaz. N. S. W., Dec. 1955]

Notes and News.

THE MADRAS AGRICULTURAL COLLEGE HOSTEL DAY CELEBRATIONS.

The Hostel Day was celebrated on 1st March 1956, with Sri S. Ganesan, Addl. District and Sessions Judge, Coimbatore, in the chair. Sri R. Balasubramaniam, Principal and Warden, welcomed the gathering. The President in his address to the students emphasised that they had to play a vital part in improving farming methods and in increasing the general cropping capacity of the State. Sri Rajaram Upadyaya proposed the Toast of the seniors, to which Sri V. Balasubramaniam responded. Sri K. M. P. Nambeesan presented the Hostel Day Rag. Sri M. Sundaram, Senior Deputy Warden, made an eloquent plea for telephones, electric fans and other modern amenities for the hostel. Sri Mohamed Kunhi Muliyar, General Secretary, Hostel Day Committee, presented the Annual Report of the hostel for 1955-56. Sri M. D. Prabhu, Junior Deputy Warden, proposed a vote of thanks. The students then entertained the guests with variety of skits and dramatic pieces.

Gleanings

Fumigation of Cocoa Beans with Methyl Bromide: Methyl bromide or monobromomethane (CH_3 Br) is a nonflammable organic compound with a boiling points of 4° C. So at normal working temperatures (15–20°) it is a gas and is able to penetrate into vegetable products, such as cocoa beans, and to kill insects living in and on these products. Methyl bromide is not only very toxic to insects but also to human beings. We have therefore investigated the following two points. Can residues of methyl bromide, remaining in cocoa beans after fumigation, be harmful to man and can these have any influence on the flavour of the cocoa, especially if made into chocolate?. In our fumigating experiments we used a dose of methyl bromide of 2 lb. per 1000 cubic feet (34 mg/1). The beans were taken from an original bag of plantation cocoa from Trinidad. The samples were packed in small bags of cotton or linen and stored in the fumigation chest on a tray for a period of 24 hours at room temperature.

After the fumigation the amount of bromide retained by the beans proved to be 20-39 p.p.m. with an average of 29 p.p.m. In the shell (16, 8%) 119 p.p.m. had been absorbed against 13 p.p.m. in the cotyledons (83, 2%). So the shell retains approximately twice as much methyl bromide as the cotyledon, which is an advantage, as only the cotyledons are used in the manufacture of cocoa and chocolate. In chocolate manufactured from the fumigated beans (with only sugar and cocoa butter added, no milk powder or other sweets) there appeared to be retained 4 p.p.m. bromine. Three manufacturers of chocolate were provided with samples of fumigated and untreated beans for the preparation of chocolate. The organoleptic tests showed no marked differences between both types of chocolate; at one time there was a slight differences in favour of the fumigated beans, at another time it was just the reverse.

While our experiments were in progress we received from the Pest Infestation Laboratory, Slough, Bucks, samples of fumigated and non-fumigated beans originating from a test in a fumigation chamber owned by one of the large cocoa manufacturers in England, and controlled by them. "The dose of methyl bromide used was 1 lb. per 1000 cub. ft. They wrote: "Chemical tests showed very small bromide residues and organoleptic tests showed no taint or loss of flavour in cocoa, chocolate, or cocoa butter manufactured from the fumigated beans". A Dutch manufacturer made chocolate from both samples, neither of us could find any marked difference in taste. This result agrees with ours. *[Bull No. 252, Tropical Products Department of the Royal Tropical Institute, Amsterdam, October, 1955·]*

[T. R. N.]

Correspondence

To

THE EDITOR,

The Madras Agricultural Journal, Coimbatore.

Sir,

In my article "Science for the Farmer — III" which you have accepted for publication in the next issue, I am afraid I have cast an unmerited slur on your plant breeding research. My only excuse is that the articles were written several years ago but only submitted for publication now, because of the recent appreciation of the need for forage production shown by the Second Five-Year Plan.

I visited for the first time some six months ago your Millets Research Section where Dr. Krishnaswami showed me the work he has been doing on forage species. He has already done valuable work by evolving two outstanding hybrids and by introducing certain new species of grasses. I was given some of this material for trial as a result of which I hasten to offer my apology to your Cyto-geneticist.

The Cumbu × Napier amphidiploid and the CO. 1 Sorghum × *S. halepense* are two very valuable hybrids. The CO. 1 × *S. halepense* is in a couple of respects even superior to Sweet Sudan we read so much of. As both parents are nutritious grasses I have no doubt the hybrid will be at least as nutritious as either of the parents.

Of the introduced grasses I find that *Setaria pallidifusca*, *S. superba*, *S. splendida* and *S. sphacelata* are far superior to the well-known Guinea grass or any other of the numerous other species I have tried. Another introduction of outstanding merit is *Pennisetum merkerii* strain.

Y. R. Farm, Kanhangad,
20—4—1956.

Yours faithfully,
R. M. SAVUR.

Weather Review — For March, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	Nil	— 0·3	1·4	South	Madurai	Nil	— 0·7	1·3
						Pamban	Nil	— 0·7	0·6
						Koilpatti*	0·5	— 1·1	1·2
	Tirurkuppam*	Nil	— 0·4	1·3		Palayamcottai	0.4	— 0·6	3·3
	Vellore	Nil	— 0·3	0·9					
	Gudiyatham*	Nil	— 0·3	0·6		Ambasamudram*	1·2	— 1·7	4·5
East Coast	Palur*	Nil	— 0·5	1·1	West Coast	Trivandrum	0·7	— 0·8	1·5
	Tindivanam*	Nil	— £2	1·6		Fort Cochin	0·2	— 1·8	4·6
	Cuddalore	Nil	— 0·7	0·7		Pattambi*	0·1	— 0·9	1·2
						Kozhikode	1·8	+ 1·4	1·8
	Nagapattinam	Nil	— 0·8	2·7		Taliparamba*	Nil	— 0·5	Nil
	Aduthurai*	Nil	— 0·6	2·1		Wynaad*	£1	— 1·2	1·1
	Pattukottai*	Nil	— 1·6	2·6		Nileshwar*	Nil	— 0·4	Nil
						Pilicode*	Nil	— 0·4	Nil
Central	Salem	Nil	— 0·5	0·3		Mangalore	Nil	— 0·5	Nil
						Kankanady*	Nil	— 0·5	Nil
	Coimbatore (A. M. O.)*	Nil	— 0·2	0·1					
	Coimbatore	Nil	— 0·5	Tr.	Hills	Kodaikanal	1·1	— 0·7	3·3
						Coonoor*	Nil	— 3·7	2·7
	Tiruchirapalli	Nil	— 0·4	0·5		Ootacamund*	Nil	— 1·1	0·3
						Nanjanad*	Nil	— 0·6	0·2

Note:— * Meteorological Stations of the Madras Agric. Dept.
Tr = Rainfall of 0·01″ to 0·04″ (Trace).
£1 = Actual Rainfall is 0·03″.
£2 = Actual Deviation is 0·04″.

In the first ten days of the month the weather was mainly dry throughout the Madras State. In this period, there was no noteworthy variation in the day temperature, which was practically near about normal. On 11—3—1956 isolated thundershowers to the extent of 1.00″ were received at Kodaikanal. Elsewhere the weather was mainly dry. In the subsequent two days also, the weather remained dry. On 14—3—1956 localised thundershowers (2″) were received at Kozhikode. In other places the weather was dry. On 15—3—1956 dry weather prevailed throughout the State. On the next day also the weather was dry, but Alleppey alone had 1·50″ of isolated thundershowers. In the subsequent two days light showers were received at a few places in south Tamilnad. On 19—3—1956 and 20—3—1956 Alleppey alone had light showers and elsewhere the weather was mainly dry. On 21—3—1956, day temperatures rose slightly over the region, but the weather remained dry on this day and also in the next two days. Trivandrum alone had 0·55″ of rain on 24—3—1956 and in other places the weather continued to be dry. From 25—3—1956 to the end of the month the weather was mainly dry. Light scattered showers were received in Travancore-Cochin State only on 25—3—1956. But in this period, there were mild variations in the day temperatures.

The seismograph in the Meteorological Office, Madras resorded at 1—52 P. M. on 18—3—1956 an earthquake shock of moderate intensity, about 1160 miles away from Madras.

Considering the month of March, 1956 as a whole, the rainfall was below normal over the entire region. Practically dry weather prevailed over the North, East Coast and the Central districts of the Madras State.

The noteworthy rainfall and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Depar-ture from normal	Remarks
11/3/56	Kodaikanal	1·0	North	Nil	— 0·3	Below normal
14/3/56	Kozhikode	2·0	East Coast	Nil	— 0·7	Far below normal
16/3/56	Alleppey	1·5	Central	Nil	— 0·4	Below normal
			South	0·4	— 1·0	Far below normal
			West Coast	0·3	— 0·6	Below normal
			Hills	0·3	— 1·5	do.

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 10—4—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Transfers

Name and present post	Posted as
Subramaniam C. R., Acting Agrl. Eng. Tractor Workshop, Coimbatore,	Assistant Agrl. Eng. River Pumping Scheme, D. A's Office, Madras.
Kasiviswanathan M., Addl. D. A. O. Pattukottai.	Agronomist, Bhavanisagar.
Ranganathachari N., Asst. Lecturer in Agricultural Economics.	Supdt. C. F. Coimbatore.
Raman Moosad C., Spl. Assistant Marketing Officer, Hosur.	D. A. O. Tellicherry.
Daniel F. L., on leave.	Asst. Agrl. Chemist, Coimbatore.
Krishna Menon K. M., Asst. Agrl. Chemist, Coimbatore.	Agricultural Bacteriologist, Coimbatore.

Upper Subordinates

Names and present post	Posted as
Subramaniam K. P., Extension Officer in Agri., Kadambathur.	A. D. Velur.

Sri K. P. Kesava Menon, Editor, Mathrubhoomi inaugurated the Second Regulated Market for coconuts and arecanuts at Thalakadathur, near Tirur, on 18th March 1956.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO A FACTUAL RECORD OF SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

MARKETING OF GROUNDNUTS

Quality Competition

Conducted by South Arcot Market Committee Cuddalore - 1955

The institution of prizes for encouraging production and marketing of commercial crops was resolved at the Conference of Chairmen of Market Committees in 1953. This scheme was first implemented in part by the South Arcot Market Committee from its own funds by instituting a 'Quality Competition' prize, to improve the quality of groundnuts.

The South Arcot markets for groundnuts are purely spot markets. The produce comes for sale only as kernels and contains moisture from anything between 1 to 10 percent besides refraction such as foreign matter, shrivelled, broken, damaged, split kernels and nooks in varied proportions. The buyers take into consideration the above refractions when quoting the prices.

The competition was open to all persons who sold groundnut kernels in any of the eight markets of the Committee. Each market was considered as a separate unit for the purpose of this competition and any lot entering the market for sale irrespective of the source of production was allowed to compete. Sellers were also allowed to enter the competition with one or more lots as the case may be on days the produce was brought for sale. Lots comprising of not less than two full bags alone were allowed to enter the competition. An entrance fee of one rupee per entry or in its place 5 lb. of groundnut kernels was also fixed.

Applications from persons desirous of entering the competition were obtained by the Market Superintendents in a form prescribed. On acceptance of the application a 10 lb. sample from the lot entered

for the competition was drawn and analysed for the various refractive ingredients of moisture, foreign matter etc. percentage of moisture in the sample was estimated in duplicate by sun-drying two pound samples in muslin cloth bags for two successive days till a constant weight was reached. The analysis was conducted by the Superintendents or Supervisors of the Committee in the presence of the competitior and one member out of a panel appointed by the Market Committee for each market; and the total refraction calculated in the sample. The lot of groundnut showing the lowest percentage of total refraction was determined as the best quality groundnut.

The competition was run for the first time by the Committee in all the eight markets during the Summer Crop of 1955. The number of entrants for the competition in each market, the results of analyses and the names of the prize winners are given in the statement appended.

Groundnut Summer Crop Quality Competition - List of Prize-Winners - South Arcot Market Committee.

Name of Market	Total No. of entrants enlisted	Name of I Prize Winner	Result of Analysis Total Refraction	Name of 2nd Prize Winner	Result of Analysis Total Refraction
Cuddalore O. T.	50	R. Venkatarama Reddiar V. Kilpathi	2.70	Balakrishna Pillai Reddichavadi	4.94
Villupuram	50	D. Padmanaba Reddi, Nemmur Village, Mel-karanai Post	6.17	C. Perianayagam Theli Village, Kappur Post	8.11
Tindivanam	42	S. Appavu Mudaliar, Olagapuram	6.18	M. Ramasami Gounder, Siruvai	6.61
Tirukoilur	28	Sadaya Kounder, Nallapalayam	3.51	Chinnathambi Gounder, Pushpapuri	4.08
Vridhachalam	33	A. Karuppa Padayachi, Kandiankollai	3.28	N. M. Kadirvel Mudr., Waviankovil P. O.	3.31
Panruti	27	R. Doraikannu Reddi, Panapakkam, Panruti	3.44	C. Perumal Gounder, Chitrachavadi	7.58
Ulundurpet	3	Ratna Udayar, Ulundurpet	13.96	N. Thillaigovindan, Ulundurpet	14.09
Chinnasalem	23	L. Kandasami Pillai, Sempadakurichi	6.05	K. Ramasami Servai, Thachur, Kallakurichi	6.98

District Prize Winner, R. Venkatarama Reddiar, in Cuddalore O. T. Market.

Review of Market Conditions of Commercial Crops in the areas of Market Committees for March, 1956.

I. **Cotton :** (In this section : Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks : Tirupur : Lint : The cotton market at Tirupur opened with a stock of 1303 cdys of Cambodia and 302 cdys of Karunganni lint. Arrivals during the month amounted to 6807 cdys of Cambodia and 506 cdys of Karunganni which included 1934 cdys of Cambodia and 126 cdys of Karunganni produced from ginneries. Despatches from Tirupur accounted for 4475 cdys of Cambodia and 179 cdys of Karunganni lint. These despatches include 2024 cdys of lint sent to Orissa, Travancore Cochin State, Madura, Pondicherry, Mysore, Malabar, Bombay, Ahmedabad, North Arcot, Madras, South Arcot, Salem, and Tirunelveli. There was a closing stock of 3635 cdys of Cambodia and 629 cdys of Karunganni lint at the end of the month.

Kapas : The kapas market at Tirupur started with an opening balance of 2353 pothis of Cambodia and 202 pothis of Karunganni kapas. Arrivals in the month accounted for 41,896 pothis of Cambodia and 3599 pothis of Karunganni and these arrivals include 12,607 pothis received from Salem. Disposals during the month amounted to 26,613 pothis of Cambodia and 1,823 pothi of Karunganni after leaving a closing stock of 17,636 pothis of Cambodia and 1978 pothis of Karunganni at the end of the month.

Koilpatti : Lint : The lint market at Koilpatti started with an opening stock of 83 cdys of Karunganni and 50 cdys of Uganda during the month. About 250 cdys of Karunganni were received during the month while disposals of 300 cdys of Karunganni lint and 50 cdys of Udganda were effected, leaving a closing stock of 33 cdys of Karunganni lint alone.

Kapas : About 2,500 pothis of Karunganni Kapas were received during the month in Koilpatti Market and the entire quantity disposed of. 500 pothis of Karunganni kapas remained as month-end carry over stocks.

Ramanathapuram District : Lint : The three markets of Virudunagar, Sattur and Rajapalayam put together opened with a stock of 365 cdys of lint while the arrivals were 3730 cdys. Disposals during the month amounted to 3830 cdys, leaving a closing stock of 265 cdys at the end of the month.

Kapas : None of the abve three markets held any opening stock. Receipts during the month amounted to 35,000 pothis and the entire quantity received was disposed of.

South Arcot District — Kapas: Arrivals were kapas only, amounting to 3 pothis. Despatches from South Arcot Markets to Coimbatore amounted to 47 pothis leaving a closing stock of 16 pothis at the end of the month.

Cotton Prices: Lint: Tirupur: The cotton market in Tirupur was very steady and the prices of Cambodia lint touched the ceiling.

Koilpatti: Prices of Karunganni lint opened at Rs. 770/- to 796/- for the best quality and gradually advanced to Rs. 800/- to Rs. 830/- per cdy during the second week. The prices remained steady thereafter. About 50 cdys of Uganda were exported to Bombay at prices varying from Rs. 1100/- to Rs. 1160/- for certified quality and at Rs. 970/- to Rs. 1000/- for the uncertified quality.

Ramanathapuram District: The opening and closing values for cotton lint in all the markets of the district ruled as follows:

		Opening:	*Closing:*
Karunganni	...	Rs. 796—821	Rs. 796—846
Uganda Lint:			
Certified MU. 1	...	Rs. 1086—1095	...
Certified MU. 2	...	Rs. 1161.	...

Kapas: Tirupur: The prices of Cambodia kapas were quoted at Rs. 135/- per pothi in the beginning of the month. Although there was a little recession in prices during the third week, the market became firm once again by the end of the month.

Koilpatti: The transactions of kapas in this market was limited during the month.

Ramanathapuram District: The opening and closing prices of Kapas in the markets of this district are quoted as follows:

	Opening:	*Closing:*
Karunganni	Rs. 111—120	Rs. 92—112

South Arcot: The average price obtained at the kapas market in this district was quoted at Rs. 79—12—0 per pothi.

Cotton Seeds: Koilpatti: The prices of Karunganni seeds opened as Rs. 48/- to Rs. 51/- and declined suddenly towards the middle of the month to Rs. 35/- to Rs. 37/- per pothi. The prices further declined in the third week to Rs. 29/- to Rs. 31/- but rose upto Rs. 33—35 per pothi by the end of the month.

Ramanathapuram District: The opening and closing prices of cotton seeds are as follows:

	Opening:	Closing:
Karunganni	Rs. 15-0-0 to 15-4-0	Rs. 10-11-0 (per Mound of $82\frac{1}{2}$ lb.)

II. **Groundnut:** (In this Section: Candy = 531 lb. of kernels. Bag = 80 lb. of pods.)

South Arcot District: All the nine markets of South Arcot, started with an opening stock of 8170 tons of groundnut kernels during the month. Arrivals into all the markets amounted to 1485 tons. Receipts from other districts and other States accounted for 2179 tons and 304 tons respectively. Consumption by oil mills and country *chekkus* was placed at 5828 tons and 171 tons respectively. Despatches from all the markets to other districts and States amounted to 339 tons and 92 tons respectively. Deducting the wastage of 217 tons, the month-end stock was 5491 tons of kernels with the trade.

The average prices at several markets ranged from Rs. 127-11-0 to 146-1-0 per candy according to quality.

North Arcot District: About 1638 tons of kernels were received into the markets during March and about 1759 tons of kernels were disposed of during the month which included 83 tons transported to Madras, Salem, Coimbatore and South Arcot. A quantity of 1050 tons of pods and 1397 tons of kernels was left over at month-end.

The prices of pods were quoted at Rs. 13 to 20/- per bag while the prices of kernels ruled steady at Rs. 136/- per candy, till the middle of the month and spurted upto Rs. 147 to 150.

Ramanathapuram District: The opening and closing rates of groundnut in the markets of Ramanathapuram district are quoted to be as follows:

		Opening:	Closing:
Groundnut pods	...	Rs. $12\frac{1}{2}$—14	Rs. 14—15 per bag.
Groundnut kernels	...	Rs. 130–140	Rs. 150–160 per candy.

III. **Gingelly: South Arcot District:** (In this section: Bag = 168 lb.)

Arrivals of gingelly in the four Markets of the district amounted to 1044 bags. Receipts from other districts like Tiruchirapalli amounted to 507 bags. Despatches from the markets of South Arcot district to other districts amounted to 541 bags. Leaving the wastage of 6 bags the closing stocks with the trade at the end of the month was 640 bags.

The average price of gingelly marketed in this district was quoted to be ranging from Rs. 60-2-0 to Rs. 66-10-0 per bag.

IV. **Coconut:** (In this section: Cdy = 700 lb.)

Coconut; stocks (In thousands): The particulars of stocks of coconuts transacted in the districts of Malabar and South Kanara are extracted below:

Name of the market	Opening balance	Arrivals	Disposals	Closing balance
Kozhikode ...	6,375	4,900	4,710	6,565
Badagara ...	682	1,425	1,242	865
Ponnani ...	600	2,000	2,000	600
Tellicherry & Dharmadam ...	680	1,112	1,118	674
Mangalore ...	55	275	270	60

Prices: The Minimum and maximum prices of coconut as between the different markets of Malabar district ranged as follows:

(In Rs. per thousand)

	Minimum	*Maximum*
Kozhikode ...	Rs. 115	Rs. 120
Ponnani ...	,, 110	,, 140
Badagara ...	,, 103	,, 115
Tellicherry & Dharmadam ...	,, 110	,, 140

The opening and closing prices of coconuts that prevailed in Mangalore market are furnished below: (In Rs. per thousand)

	Opening:	*Closing:*
Raw	Rs. 125—155	Rs. 120—155
Dry	Rs. 150—200	Rs. 150—200

Copra: The stock position of copra in Malabar and Mangalore Markets are extracted below:

Name of the market	Opening balance	Receipts	Disposals	Closing balance
(Malabar district in candies.)				
Kozhikode ...	6,008	13,500	14,020	5,488
Badagara ...	597	2,848	3,065	380
South Kanara district				
Mangalore ...	60	270	235	95

Prices: The prices of copra of different varieties at several markets of Malabar district are furnished below:

(*Prices in Rs. per candy*)

		Kozhikode		*Badagara*	
		Minimum	Maximum	Minimum	Maximum
Office	...	Rs. 280	Rs. 285	Rs. 270	Rs. 285
Edible	...	,, 290	,, 295	,, 290	,, 295
Madras	...	,, 300	,, 315	,, 300	,, 300
Rajpur	...	,, 325	,, 335	,, 325	,, 335

The prices of copra in Mangalore market were quoted at Rs. 265/- to Rs. 295/- per cdy.

V. **Arecanut:** (In this section, Bag = 100 lb.)

Stocks: The stock particulars of arecanuts in Malabar and South Kanara districts are extracted below:

		Opening balance	*Receipts*	*Disposals*	*Closing balance*
Malabar District (in bags)					
Kozhikode	...	Nil.	15	15	Nil.
Palghat	...	275	Nil.	175	100
Ponnani	...	1,360	Nil.	1,060	300
South Kanara district (in cwts).					
Mangalore (supari)		21,400	29,750	28,350	22,800

Prices: Prices of Arecanut (Choor) in Palghat ranged between Rs. 165/- to Rs. 172/- per bag each

The price ranges of supari in Mangalore market of the different varieties are noted below:

(Price in Rs. per cwt.)

		Minimum	*Maximum*
Koka	...	Rs. 80	Rs. 120
Choll	...	,, 170	,, 195
Malabar Supari	...	,, 120	,, 145
Mangalore ,,	...	,, 130	,, 165

VI. **Tobacco (Tiruppur):** (In this section, Candy = 500 lbs.)

Stocks: The tobacco market at Tiruppur started with an opening balance of 3058 cdys of chewing and 480 cdys. of cheroot tobacco. About 30 cdys of beedi tobacco are reported to have been imported during the

month. Despatches in the month amounted to 1235 cdys of chewing variety to places in Travancore-Cochin State, Palghat, Madras, Dindigul, Tanjore, Tiruchirapalli and Vedaranyam. At the end of the month there was a closing stock of 3555 cdys of chewing tobacco.

Prices: The prices of different varieties of tobacco for different grades ruled at the ranges furnished below:

(Prices in Rs. per cdy of 500 lb.)

1. *Chewing Tobacco, Sun-cured:*

		I grade	*II grade*	*III grade*
Meenampalayam	...	400 — 460	300 — 400	150 — 260
Other varieties	...	300 — 335	200 — 250	115 — 150

2. *Cheroot varieties*.

Sun-cured (grown in Erode and Bhavani Taluks.)	...	—	—	—

3. *Chewing varieties:*

Pit-cured (grown in Palladam and Sulur areas.)	...	300 — 375	200 — 275	125 — 200

Review of the Activities of the Market Committees during March 1956

All the Market Committees continued to function during the month. Except the Coimbatore Market Committee which is functioning under an elected body all the other Market Committees are working under the respective Collectors or his nominees under Section 6A of the Act. Necessary steps are continued to be taken to conduct fresh elections of these Committees.

The following progress was made by the Market Committees in the issue of licenses under the provisions of the Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	128	467	74	363	48	192	3	3
South Arcot Market Committee	174	888	139	810	122	740	3	3
Coimbatore Market Committee	119	274	134	329	40	218	—	—

	Section 5 (1) A	Section 5 (1) B	Section 5 (3) A	Section 5 (3) B	Weighmen A	Weighmen B	Broker A	Broker B
Tirunelveli Market Committee	—	3	—	1	—	—	—	—
Ramanathapuram Market Committee	1	4	—	3	—	—	—	—
Malabar Market Committee	15	209	156	904	5	144	2	5
South Kanara Market Committee	4·6	163	41	138	9	51	—	—

Meetings: A meeting of the Coimbatore Market Committee was held on 30—3—1956 in the Office of the Committee, Tirupur when fourteen subjects were discussed at the meeting. A few of the subjects dealt with at the meeting are extracted below.

(a) The Committee approved the Administration Report for 1955.

(b) The Committee resolved to execute an agreement with the Tirupur Sale Society on certain conditions.

(c) The Committee resolved to purchase the requirements of departmental publication from the Agricultural Department and sell them to the public at the Committee's regulated markets.

Quality appraisal: 160 samples were drawn and analysed to quality factors from out of 2561 lots comprising of 23111 bags of groundnut kernels in six markets of the South Arcot Market Committee. The total common refraction was below 4% in 75 samples, 5 to 8% in 79 samples and above 8% in 6 samples. The details of analysis which may be of interest are extracted below:

Particulars	Cuddalore	Villupuram	Tindivanam	Virudhachalam	Panruti	Kallakurichi
1. *Dryage:*						
2% and below ..	—	—	14	28	—	—
above 2% and upto 3% ..	2	1	—	4	1	—
above 3% and upto 4% ..	2	1	10	6	10	6
above 4% and upto 5% ..	2	—	6	—	1	6
above 5% and upto 10% ..	7	6	17	—	7	12
above 10% ..	3	—	6	—	1	1
2. *Total refraction:*						
4% and below ..	9	4	19	12	20	11
above 4% and upto 8% ,,	7	4	34	26	—	8
above 8% ..	—	—	—	—	—	6

Crop & Trade Reports

Korra crop — Second Report, — 1955 — '56 — Madras State: The area sown with korra or tenai *(Setaria italica)* in the Madras State upto the 25th December 1955 is estimated at 75,800 acres. Compared with the area of 78,500 acres estimated for the corresponding period of the previous year, this is a decrease of 3.4 per cent. As compared with the average area of 70,500 acres, calculated for the five years ended 1954—'55, the present estimate shows an increase of 7.5 per cent. Statements showing the district-wise estimates of area and production of the *Kharif* crop (sown during the period June to October 1955) and preliminary estimates of area under the *rabi* crop (sown during November and December 1955) are enclosed. The *kharif* crop has been or is being harvested. The yield per acre is estimated to be normal in South Arcot and Tirunelveli districts and below normal in all the other districts of the State, except South Kanara, where the crop is not cultivated. The Seasonal factor for the State as a whole works out to 96 per cent of the normal for the *Kharif* crop, as against 95 per cent estimated for the corresponding period of the previous year. The yield of the *Kharif* crop works out to 18,600 tons of unhusked grain or 14,900 tons of cleaned grain, as against 19,000 tons of unhusked grain or 15,200 tons of cleaned grain estimated for the corresponding period of the previous year, representing a decrease of 2.1 per cent. As compared with the average production of 15,700 tons of unhusked grain or 12,600 tons of cleaned grain calculated for the five years ended 1954—'55, the current year's estimate is an increase of 18.5 per cent.

Varagu — Second Report — 1955 — '56 — Madras State: The total area sown with varagu *(Paspalum scrobiculatum)* in the Madras State upto the end of December '55 is estimated at 606,300 acres. Compared with the corresponding estimate of 597,800 acres for the previous year, this is an increase of 1.4 per cent. As compared with the average area of 538,200 acres calculated for the five years ended 1954 — '55, the current year's estimate shows an increase of 12.7 percent. Statements showing the district-wise estimate of area and production of *Kharif* crop (sown during the period from June to October '55) and preliminary estimates of area under *Rabi* crop (sown during November and December '55) are enclosed. The *Kharif* crop has been or is being harvested. The yield per acre is estimated to be normal in the districts of Chingleput and South Arcot and below normal in all the other districts of the State, except South Kanara and the Nilgiris where the area under the crop is nil or negligible. The condition factor for the State as a whole works out to 96 percent of the normal as against 95 percent estimated for the corresponding period of the previous year. The yield of the *Kharif* crop works out to 218,500 tons of unhusked grain or 131,000 tons of cleaned grain as against 216,700 tons of unhusked grain or 130,000 tons of cleaned grain estimated for the corresponding period of the previous year, representing an increase of 0.8 percent. As compared with the average production of 176,000 tons of unhusked grain or 105,600 tons of cleaned grain calculated for the five years ended 1954 — '55, the present estimate is an increase of 24.1 percent.

Samai — Second report — 1955 — '56 — Madras State: The total area sown with Samai *(Panicum miliare)* in the Madras State upto 25th December 1955 is estimated at 406,500 acres. Compared with the area of 391,600 acres estimated for the corresponding period of the previous year, the present estimate is an incease of 3.8 percent. As compared with the average area of 336,900 acres calculated for the five years ended with 1954—'55, the present estimate shows an increase of 20.7 per cent. Statements showing the district-wise estimates of area and production of *Kharif* crop (sown during the period June to October 1955) and preliminary estimates of area under *Rabi* crop (sown during November and December 1955) are enclosed. The *Kharif* crop has been or is being harvested. The yield per acre is estimated to be below normal in all the districts of the State except South Arcot and South Kanara where it is expected to be normal. The seasonal factor for the State as a whole works out to 95 per cent of the normal as against 93 per cent estimated for the corresponding period of the previous year. The yield of the *Kharif* crop works out to 60,000 tons of unhusked grain or 33,000 tons of cleaned grain as against 56,700 tons of unhusked grain or 31,200 tons of cleaned grain estimated for the corresponding period of the previous year, representing an increase of 5.8 per cent. As compared with the average production of 45,909 tons of unhusked grain or 25,200 tons of cleaned grain, calculated for the five years ended with 1954 — '55, the current year's estimate shows an increase of 30.7 per cent.

RETIREMENT

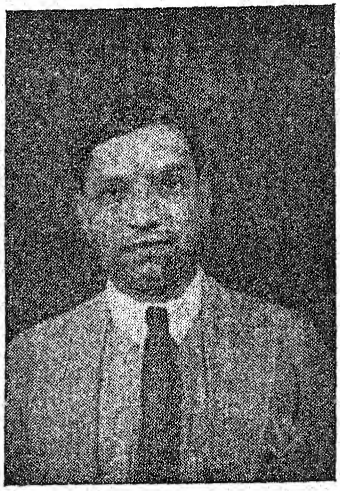
SRI R. BALASUBRAMANIAM, B. A., B. SC. (Ag.)
Principal, Agricultural College and Research Institute, Coimbatore
(1953 — 1956)

The most notable event of this month was the retirement of Sri R. Balasubramaniam, from the post of Principal, Agricultural College and Research Institute, which he has been holding with great distinction and success since January 1953. He is succeeded in this post by Dr. K. C. Naik, M. Sc., Ph. D. (Bristol).

Sri R. Balasubramaniam's tenure as Principal is unique in that it was the first occasion when a graduate of this College has held the post of Principal. He was one amongst the first batch of students who were admitted to the newly instituted degree course in 1920, when the old Diploma Course was transformed into a degree course of the Madras University. After passing out of this College in 1923, he joined the Department as a Research Assistant in the Cotton Section and by sheer force of his intellect and industry worked his way up to occupy eventually one of the highest and most covetet posts in our Department. As a research worker in cotton, he can claim several outstanding successes and in fact the major portion of the credit for the high reputation that the Madras strains enjoy amongst Indian cottons should be attributed to Sri R. Balasubramaniam's work. In the field of administration too, he has been equally successful, by bringing to bear upon all problems a happy combination of critical insight and impartial judgment. The Madras Agricultural Students' Union, is particularly indebted to him for the sustained interest and never-failing help that he has been giving all its activities. We feel confident that his knowledge and experience will surely be utilised for many more years in the cause of agricultural research in Madras.

We welcome as his successor Dr. K. C. Naik, who has also had an equally distinguished career in our Department and is held in high esteem as an authority in the field of horticulture. We are sure that under his charge both agricultural education and the future of the Union are in very safe and capable hands.

PATRONS



SRI S. N. VENKATARAMAN, B. A., B. SC. (Ag.)

We are happy to welcome Sri S. N. Venkataraman, Retired Headquarters Deputy Director of Agriculture, as one of our new Patrons for this year. The Union is certainly honoured in having him in its roll of patrons, as he is not only one of our oldest members, since 1920, but was also one of the best-known and highly respected officers of the Agricultural Department.

Sri S. N. Venkataraman belongs to the very first batch of B. Sc., (Ag.), students who joined the Agricultural College, in July 1920 when the course was converted from a Diploma course into a degree course affiliated to the Madras University. He was also one of the outstanding students in his batch, distinguished both in studies and in games. After passing out of this college, he joined the cotton section as a research assistant in 1923. It can be rightly said that he was the first man to gain a a sound knowledge of statistical methods, many years before the subject was recognised as an essential tool in all agricultural and biological research work. As a research worker in cotton he had a number of publications to his credit. Later on, as Assistant Marketing Officer first and then as the State Marketing Officer he was responsible for a rapid development of the Marketing Section and helped to organise the various Market Committees that are now functioning in different districts for different crops. One of his outstanding contributions in this line was his survey of Cotton Marketing in Madras State. For a few years before his retirement in January 1956 he held the very responsible post of Headquarters Deputy Director of Agriculture and here as in all other fields, be succeeded in being both popular and efficient at the same time.

He was in his college days an all-round sportsman who was particularly good at cricket and football. As a man he was a charming personality, ever smiling and courteous to all who could always command the respect and regard of his subordinates. His love for his Alma Mater and real interest in the Union are well revealed by his becoming a patron of the Madras Agricultural Students' Union, soon after his retirement. We wish him all happiness in his retired life.

SRI C. M. JOHN

The Madras Agricultural Students' Union, is honoured by the recent addition to its roll of patrons, of Sri C. M. John, retired Director, Central Coconut Research Station, Kasargode. He has been closely associated with the Union in all its activities, ever since he joined the Agricultural Department in 1922 as a research assistant in paddy. Rising virtually from the ranks, he became in due course Oilseeds Specialist in 1939 and Principal, Agricultural College, Bapatla in 1947 and later on became the Principal of the Agricultural College and Research Institute, Coimbatore as well. In 1950, his services were lent to the Indian Central Coconut Committee for appointment as Director of the Central Coconut Reserch Station at Kasargod. He retired from the Agricultural Department in June 1953 and continued as the Director of the Central Coconut Research Station at Kasargode till 1955.

Sri C. M. John is not only a capable research worker, with numerous publications to his credit, but is also a very able administrator, who has a happy knack of getting the best out of every one of his subordinates. As a member of the Madras Agricultural Students' Union, for an unbroken period of more than thirty years, he has served in various capacities in the Union, as Editor, Vice-President, and as President.

We welcome him as our new Patron and feel confident that he will continue to take the same keen interest in the Union as he has evinced all along.

Studies on *Volvaria diplasia* Berk & Br., The Paddy Straw Mushroom

by

G. RANGASWAMI, PH. D.
(Institute of Microbiology, Rutgers University
New Brunswick, New Jersey, U. S. A.)

Introduction: Sporophores of some species of the genus *Volvaria*, occurring in nature in the tropical regions, are known to be edible. At least three of its species, *V. volvacea*, (Bull.) Quelet, *V. esculenta* Massee and *V. diplasia* Berk & Br., are reported to be artificially cultivated in some countries of Asia (2, 3, 4, 7, 9, 11, 14). All the three species grow well on rice straw and are popularly known as 'Paddy straw mushroom'. Another closely related species, *V. bresadolae* Trotter, has been reported to grow on decaying pine apple fruits in Palau Island (U. S. A. Trust), Pacific Ocean (6).

It is believed that *V. volvacea* has been under commercial cultivation prior to 1932 in China (2). The natural occurrence of this species in Malaya and the possibilities of its commercial cultivation was reported by Sands in 1935 (9). In 1936 Benemerito (3) described in detail the method of cultivation of *V. esculenta* in the Philippine Islands and Su that of *V. diplasia* in Burma (11). Thomas *et al* (14) were the first to grow *V. diplasia* in Coimbatore, India, and to describe in detail the method of its cultivation. Subsequently Bertus (4) reported successful cultivation of this species in Ceylon and Asthana on the possibilities of growing it in the Central Provinces, India, (1). Cultivation of *V. volvacea* has also been reported from Madagascar and Java by Bouriquet (5) and Reitsma and Hadiwidjaja (7) respectively.

Investigations into the possibilities of improving the yield of *V. diplasia* in straw beds were made by Su (12) and Seth (10). There was no difference in the yields obtained by either inoculating each layer or alternative layers of the bed, whereas increased yields could be obtained by using fresh spawn instead of four-month-old spawn. Increased yields could also be obtained by applying two gallons of water to the bed both in the morning and in the evening and also by adding ground seeds of pigeon pea (*Cajanus cajan* (L.) Millsp.) or chick pea (*Cicer arietinum* L.) to the spawn. Asthana (1) in 1947 also found that when powdered *dhal* (seeds of pigeon pea or chick pea) was not added to the medium the sporulation (sporophore formation) was scanty.

Investigations into some of the factors controlling the development of sporophores of *V. diplasia* in straw beds and the possibilities of increasing the yield of the mushroom were made and also some of the cultural and physiological properties of the fungus in various media studied and the results are reported in this paper.

Materials and methods: A fresh isolate of the fungus obtained from an unopened sporophore (button) and subsequently brought into pure culture by single hyphal tip method was used in all these studies. The method of preparation of spawn (inoculum) and cultivation of the mushroom were essentially the same as recommended by Thomas *et al* (14) and deviations, if any, have been indicated in the text. The beds were laid in shaded areas of the greenhouse well protected from wind and rain.

The media used for the cultural and physiological studies of the organism were prepared according to Riker and Riker (8). For plate culture studies 15 ml portions of melted agar medium were poured in 10 cm petri dishes and inoculated in the centre with 4 mm discs of the fungus taken from a week-old culture. The radius and nature of growth of the fungus was recorded after 5-10 days. For liquid culture studies 100 ml portions of the media in 250 ml Erlenmeyer flasks were inoculated with 4 mm culture discs as in plate cultures and allowed to grow for various lengths of time. The dry weight of the mycelium was obtained in the usual manner. Both the plate and liquid culture studies were made in quadruplicate and and the average of the results are presented.

Experimental Resuls: *Study of the factors involved in mushroom culture:* In general it is believed that April to June is the best period for the cultivation of this mushroom. In order to obtain some information on the factors involved in this phenomenon two beds were laid every month during 1947 in the recommended manner and the yields of mushroom recorded. The maximum and minimum atmosheric temperature and relative humidity during the period of each culture was also recorded and the results are presented in Fig. 1. The yield of the mushroom was found to be greatly influenced by the minimum temperature and relative humidity rather than the maximum temperature and humidity. The total number of mushrooms obtained from each bed is directly proportional to the total weight of the mushroom, indicating thereby the non-variability of the average size of the mushrooms throughout the year.

It was advocated that the beds should be watered every day either in the morning or in the evening or both times (10, 12). With a view to find out the influence of alternate wetting and drying on the yield, four beds were laid in identical manner and watered at different intervals, the total quanity of water applied to each bed being constant. The experiment was repeated three times during April, May-June and August, 1947 and the average yield recorded (Table I).

TABLE I

Effect of alternate wetting and drying on the yield of mushrooms

Treatments	No. of mushrooms per bed	Total Wt/bed (Oz.)	Average Wt. (Oz.)
Watering on the first and on the eighth day	168	119	0·71
Watering once in three days	162	99	0·61
Watering once in two days	140	39	0·64
Watering daily	126	82	0 65
No watering	0	..	..

Watering the beds at longer interval seems to favour sporophore formation. There was no significant difference in the average weight of the mushrooms in different treatments.

According to Su and Seth (13) the average size of a mushroom bed should be approximately $3\frac{1}{2}' \times 3\frac{1}{2}' \times 2'$ and according to Thomas *et al* (14) approximately $3\frac{1}{2}$ to $4'$ cube. Nearly 75 to 100 lb. of rice straw is required to heap such a bed. The possibilities of growing the mushroom in smaller-sized beds was investigated by the following methods:

1. Beds of $10'' \times 8'' \times 6''$ were laid on wooden planks in the manner recommended for the normal beds and the edges covered with a thin paste of equal parts of cowdung and clay to provide sufficient compactness inside the bed. The surface coating was kept moist by sprinkling water periodically.

2. Beds of $10'' \times 8'' \times 6''$ laid as above without the surface coating.

3. Beds of $10'' \times 10'' \times 9''$ laid inside open glass jars of $18'' \times 10'' \times 10''$ so as to cover only a portion of the area. The beds were kept sufficiently moist and the excess water accumulating at the base was syphoned out periodically.

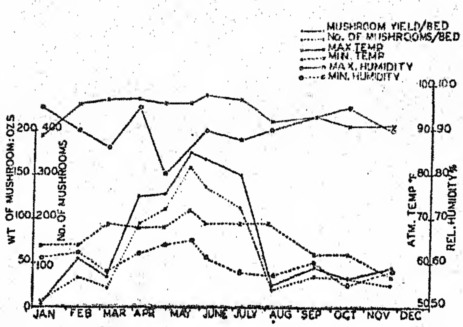


Fig. 1

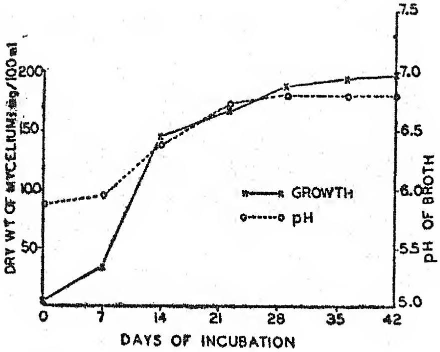


Fig. 2

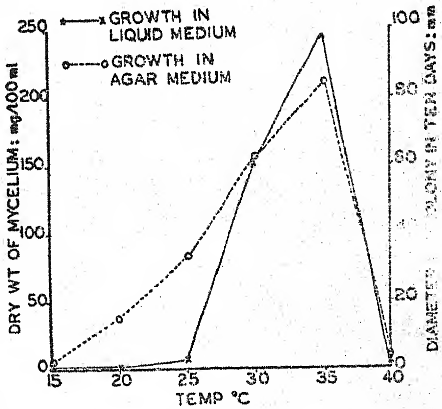


Fig. 3

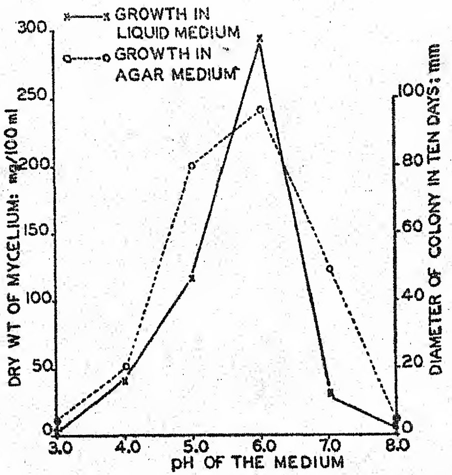


Fig. 4

Fig. 1: Yield of the mushroom during different seasons of 1947 as influenced by atmospheric temperature and relative humidity.

Fig. 2: Rate of growth of *V. diplasia* in nutrient broth.

Fig. 3: Influence of pH on the growth of *V. diplasia* in nutrient medium.

Fig. 4: Effect of temperature on the growth of *V. diplasia* in nutrient medium.

In the first case a few buttons appeared on the surface of the coating after 20 days but none of them developed into normal mushrooms, whereas in the second case a few normal-sized mushrooms developed from below the wooden plank on which the bed was laid but not on the straw layers. The fungal mycelium developed rapidly in the beds laid in glass jars and within 12 days there was normal development of mushrooms (Fig. 7).

Cultural and physiological properties of V. diplasia: At present very little is known about the cultural characteristics and nutritional requirements of *V. diplasia* and other species of the genus. The following studies were made to find out a suitable medium and optimum conditions required for growing the fungus in the laboratory and also to understand its capability to utilize different carbon and nitrogen sources.

Growth on different media: The cultural characters of *V. diplasia* were studied by growing on different complex organic and synthetic media at pH 6.0 to 6.4. On inculation the plates were incubated at room temperature (28 – 32°C) for 7 days and the results recorded (Table II).

TABLE II

Cultural characteristics of V. diplasia on different media

Medium	Diameter of colony (mm)	Nature of growth
Nutrient agar	49	Fairly good growth with colourless submerged hyphae. Greyish - brown pigment produced.
Potato dextrose agar	57	Soft woolly mycelium, mostly submerged and colourless.
French bean agar	53	Growth as above.
Richards' agar	38	Poor growth with thin hyaline submerged, mycelium.
Brown's agar	78	Very thin growth made of mostly submerged quickly spreading hyaline mycelium.
Oat agar	49	Very thick, whitish, cottony aerial mycelium and colourless thick submerged hyphae. No soluble pigment produced.
Carrot agar	50	Thin colourless mycelium, mostly aerial with few submerged hyphal strands.
Corn meal agar	76	Very good white aerial mycelium and light yellow submerged hyphae. No soluble pigment produced.

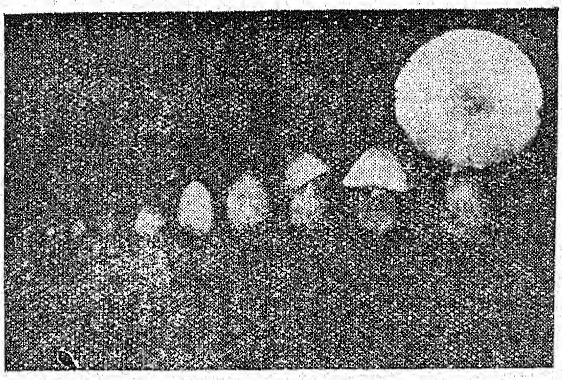


FIG. 5

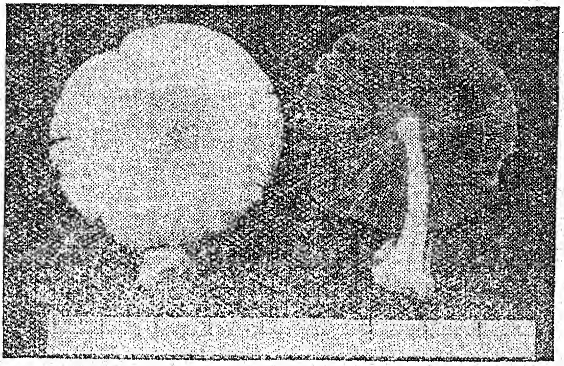


FIG. 6

FIG. 7

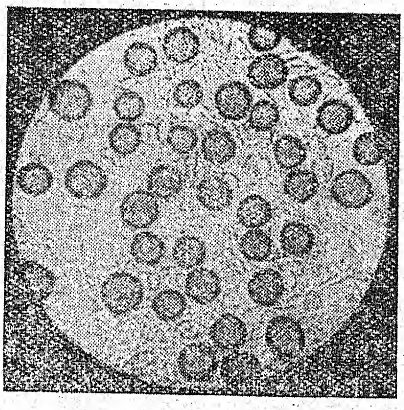


FIG. 8

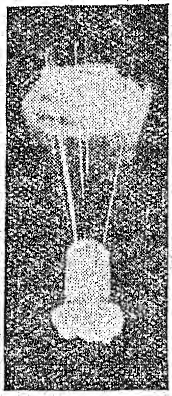


FIG. 9

FIG. 5: Different stages in the development of sporophores of *V. diplasia.*
FIG. 6: Fully developed sporophores.
FIG. 7: Development of sporophores in miniature beds inside glass jar.
FIG. 8: Photomicrographs of chlamydospores of *V. diplasia*, (335X).
FIG. 9: Growth and development of chlamydospores (dark growth along the edge and in the center of the medium) of *V. diplasia* in peptone broth.

Corn meal agar and oat agar were found to be highly satisfactory for growing the fungus and fairly good growth was also obtained in nutrient agar medium. There was abundant formation of dark brown chlamydospores after ten days in oat agar medium (Fig. 8), whereas no chlamydospores could be observed on other media even after thirty days' incubation.

Optimum pH and temperature for the growth of the fungus: The rate of growth of the fungus as well as the effect of pH of the medium and incubation temperature on the growth were studied in liquid and agar media. For this purpose nutrient broth and nutrient agar media were selected, despite the fact that corn meal and oat agar gave better growth of the fungus, because the latter media were found inconvenient for liquid culture studies. The growth and pH of the medium levelled off after 28 days (Fig. 2). The H-ion concentration around 6·0 and an incubation temperature around 35°C seem to be most suitable for the growth of the fungus (Figs. 3 and 4).

Utilization of carbon and nitrogen sources by V. diplasia: A basal medium containing 10 g of KNO_3, 5 g of KH_2PO_4, 2.5 gm of $MgSO_4.7H_2O$ and 25mg each of $FeSO_4.7H_2O$, $MnSO_4.H_2O$ and $ZnSO_47H_2O$ per liter (pH adjusted to 6·0) was prepared and 2% w/v of different carbon sources added. The growth of the fungus in each case was recorded as dry weight of mycelium in liquid media or as diameter of the colony on agar media (Table III).

TABLE III

Utilisation of carbon sources by V. DIPLASIA

Carbon source	Nature of growth*	Diameter of colony in agar medium after 7 days (mm)	Dry wt. of mycelium in liquid culture after 22 days (mg/100 ml)
Sucrose**	+++	72	103·5
Glucose	+	52	9·6
Maltose	+	37	5·1
Lactose	+	60	8·7
Cellulose	±	21	2·3
Starch	++++	74	252·1
No carbohydrate	0	62	..

* 0 to ++++ : increasing amounts of growth.
** : cane sugar.

Starch was found to be by far the best source of carbon for the growth of the organism, while cane sugar ranked next.

In a similar experiment using the same basal medium with 20 gm of sucrose substituted for 10 gm of KNO_3, the capability of the fungus to utilize different nitrogen sources was studied (Table IV).

TABLE IV

Utilization of different nitrogen sources by V. DIPLASIA

Nitrogen source	Nature of growth*	Diameter of colony in agar medium after 7 days (mm)	Dry wt. of mycelium in liquid culture after 22 days (mg/100 ml)
KNO_3	+++	48	67·9
KNO_2	0	0	1·8
$(NH_4)_2SO_4$	++	62	51·4
Asparagine	++	53	45·5
Urea	+	88	28·7
Peptone	++++	66	623·4

* 0 to ++++ : increasing amounts of growth.

Best growth was obtained with peptone while the organism could also utilize to some extent KNO_3, $(NH_4)_2SO_4$ and asparagine as nitrogen sources. There was abundant chlamydospore formation along the edges and surface of the medium containing peptone (Fig. 9.)

Discussion and Conclusions: Even though *V. diplasia* formed sporophores in straw beds throughout the year, comparatively high yields were obtained only during April-July. These results are in agreement with the previous reports (1, 13). Whenever the atmospheric temperature fell below 68-69°F, together with a similar drop in the relative humidity below 65%, there considerable reduction in the yield. These findings are supported by the fact that there was very little growth of the fungus in artificial media below 20°C (68°F) (Fig. 4). Besides other cultural factors have been found to greatly influence the sporophore formation; the yield was higher when the beds were watered at longer intervals; there was normal development of mushrooms in miniature beds laid in open jars. Watering at longer intervals results in alternate wetting and drying of the bed and probably creates favourable conditions for the reproductive phase of of the fungus. These results indicate that under certain conditions it is possible to induce sporophore formation and eventually increase the yield. Further detailed studies, however, are necessary to draw any final conclusions.

The capability of the fungus to utilize starch but not cellulose indicates that some complex metabolic processes are involved in the utilization of rice straw as a carbon source by *V. diplasia*. It is possible that the associative microflora of the straw bed influence the utilization of the nutritive material by the fungus and these micro-organisms in turn might be influenced by the climatic factors which are prevalent during certain seasons of the year.

The three species of *Volvaria* Viz., *V. volvacea, V. diplasia* and *V. esculenta,* are differentiated chiefly on some morphological bases but their habitat seem to be identical and very little is known about their physiological properties. It is believed that a comparative study of their morphological, cultural and physiological properties would result in better knowledge of these useful and economically important species. It would also be advisable to explore the possibilities of introducing the species into other countries, improving their yield by strain selection, induced mutation etc., and growing them on other agricultural waste products.

Summary: A study of the factors influencing the sporophore formation of *V. diplasia* in rice straw beds was made. There was some direct correlation between the minimum atmospheric temperature and relative humidity and the yield of the mushroom per bed. Under certain conditions it was found possible to induce sporophore formation in smaller-sized beds and also to increase the yield per bed by altering the spray schedule.

Among the complex organic and synthetic media tested for growing the fungus corn meal and oat agar were found to be most satisfactory, nutrient agar ranking next. The fungus was found to grow well in nutrient medium with a pH reaction of 6.0 around 35°C and to readily utilize starchas carbon source but not cellulose. Peptone was the best nitrogen source for the growth of the fungus even though it could utilize KNO_3, $(NH_4)_2SO_4$ and asparagine to some extent. There was abundant chlamydospore formation by the fungus in oat agar and peptone broth.

Acknowledgement: The author wishes to express his appreciation to Messrs. K. M. Thomas, D. Marudarajan and T. S. Ramakrishnan, retired Mycologists, Government of Madras, India, for providing the facilities and for their continued interest in these investigations.

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A Technical Note on Coir-rope Filter-Points for Tube Wells in the Madras State.

by

Sri B. M. LAKSHMIPATHI, B. E., M. E., M. R. A. S. E.,

General: The "drive points" made completely of metal also called "Filter Points" are made in a variety of types and their choice depends upon the soil structure in the water-bearing stratum. Ordinarily an inner mesh of size 60 is used in these drive points. The generally advocated type of filter point is made of G. I. material consisting of a sufficient length of G. I. pipes of about 6 feet length and diameter 3″ or 4″ with holes not more than 1/2″ diameter drilled on it at distances varying from 1″ to 1½″ centres. These drilled holes are arranged in a staggered manner and their number and size are limited so that the drive point will not lose its strength. This 6 foot G, I. pipe is closely jacketed with a 60 mesh metal cloth of either copper, brass or galvanised iron. This square mesh cloth is again covered over by a brass or G. I. perforated sheeting. Both these metal covers are welded or soldered at the top and at the bottom to G. I. pipe to avoid being torn while driving in the filter point. A solid G. I. tip of slightly larger diameter than the drive point itself, to pierce the soil and which when driven down will open up a passage way for the point, is fitted at the bottom of the filter point. On the top of the filter point, a coupling of the correct diameter is screwed and welded. The approximate cost of a 4″ size metal filter point ranges from Rs. 129/- to Rs. 130/-.

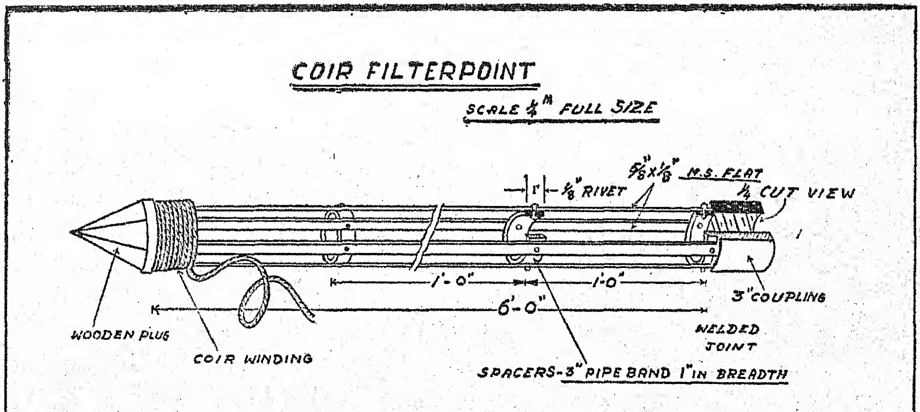
This drive point coupled with the required length of the G. I. pipes is driven down gradually till it reaches the coarse sandy water-bearing stratum and a successful aquifer is met, enabling pumping with this system.

Object: The conventional types of filter points are generally used by agriculturists in sinking tube wells for tapping underground water. These fine-meshed filter points are effective in filtering off coarse sand, dirt and sticky mud particles. But when these are driven in layers with very fine sand, dirt and sticky clay, the drive points are not so very permeable and even fail. This is because while the coarse grained layers help keep open the pores and allow the water to flow into the filter point, the fine sand and mud particles stick to the surface and choke the pores on the fine

mesh. In such places, it is necessary to have the filter point cleared every now and then by 'surging'. This is very laborious, difficult and uneconomic to be adopted by an ordinary ryot. It also needs technical skill and an ordinary ryot cannot afford to have ready recourse to such techniques.

In order to overcome these drawbacks the Department had been experimenting on modifications to these metal type filter points so that they can be manufactured at lesser cost and used in any kind of sandy layer without fear of choking.

With the above objects in view the design and manufacture of cheap, efficient and new type of drive points using flat iron and coir rope wound around in place of the G. I. perforated and metal mesh jackets, were taken up by the Department independently of any work of similar nature in other parts of India. Preliminary experiments in the manufacture of such types and field trials have so far been encouraging.



Fabrication of the Coir Rope Filter-Point: This type of coir filter point (see figure appended) consists of a cylindrical framework formed by placing six numbers of 6 foot - long mild steel flats of size 1/8" x 5/8" all round at equal distances over 1" wide circular bands of 3" diameter spacers and kept in position either by welding or by rivetting. The number of such spacers is normally 6 for 3" size coir filter points. These circular spacers are rivetted or welded at 1' to 1½' intervals along the length of the cylinder to give shape to the design of the filter point. In rivetting the flats are firmly

fixed over the circular spacers by means of 1/8" m. s. rivets. At the bottom a conical wooden plug is fitted tight with the apex pointing downwards. At top of the filter point a 3" size coupling is fixed rigidly over the top spacer and welded. For coarse sandy strata a single winding with a double twist coir rope strand will suffice, while for fine sandy layers, two windings one over the other are necessary to prevent the entry of fine sand.

The thickness of the coir rope normally used over the filter point frame may be anything between 3/16" to 1/8" or even more, depending upon the size of the filter point it self and the nature of the stratum below.

Method of installation of the Coir Rope Filter Point: The coir rope filter-point tube well is installed in the same manner as the metal filter-point tube well. In this process the outer casing pipe is first worked down into the bore with the help of augurs and sand shells and then the coir rope filter point with fittings is lowered to the required depth.

No hammering or twisting of the pipe connections is to be attempted as it will damage the wound coir rope on the filter point. Once the coir rope filter point tube well is embedded in the aqueous layer, the casing pipe is withdrawn. It is advisable to pour in simultaneously with the withdrawal of the casing. coarse sand into the space between the bore and the casing as to form a sandy layer around the coir rope filter point. This will act as a good filtering medium for the coir rope filter-point and also reduce choking of the strainer by fine sand and clay particles, in the initial stages of developing the bore.

Cost of Fabricating a3" Coir Rope Filter-Point: The coir rope filter point is cheaper than the conventional type counterpart. This can be easily fabricated and the approximate cost of manufacturing one 3" coir rope filter point may vary from Rs. 18 to 20.

The manufacturing cost of these coir rope filter-points can be reduced still further when produced in larger numbers.

A few test trials of these coir rope filter-point fitted tube wells with regular metal counterparts in the same bores have shown that the yield obtained from the coir rope filter point tube well is about 10 to 20% more than that obtained from the metal type. This extra yield can thus be attributed to the proportionately

larger pores surface area provided by the coir filter-point for the inflow of the water.

Observation of other workers on suitability of coir as filters:

(1) Experiments conducted by Dr. Mackenzie Taylor, Director, Irrigation Research, Punjab P. W. D., on the use of coir as a material for the construction of a tube-well strainer showed that :–

(i) In coir used as a tube-well strainer which was always submerged in water, there was little deterioration of the filter.

(2) The submersion of coir in water containing salts in quantities such that it is suitable for drinking and irrigation or having an alkalinity of the order usually met with will not lead to deterioration of the coir at a measurable rate;

(3) No serious deterioration of the coir need be anticipated in either alkaline or acid waters.

(4) There is little danger of coir fibre deteriorating when used as a tube-well strainer under the conditions met with in the strata.

(5) The use of coir rope as a strainer will present an almost continuous filtering surface to the water.

(6) The effective filtering surface in the case of coir being large and liability of choking less than in the slotted form of strainers the material seems to be most suitable for filtering medium.

Summary & Conclusion: From the data obtained so far from the limited number of installations and the observations on coir rope filter point elsewhere it may be summarised as follows :–

In the coir rope filter point the porosity is considerably increased. This type presents a complete filtering medium to the flow of water inside the tube well and thus enables more water to get into the column. The percentage of fine sand passing through this strainer is practically nil. No electro-chemical action is produced, unlike the metal drive points. Incrustation on the surface of the coir rope filter point by lime deposits will be nil as against that on metal strainer. There is no concentration of flow

of water in this type of filter and hence no concentration of the material around it. These coir rope filter points are found to be least affected by the prolonged immersion in underground water and there was very little deterioration even after four years of continued submersion.

The most salient feature in this type is its low cost of manufacture. For, while a coir rope filter - point of 4" size will cost approximately Rs. 25/- to manufacture, a metal type counterpart of factory make will cost anything from Rs. 120/- to Rs. 150/-.

REFERENCE

Dr. E. Mackenzie Taylor, Director, Irrigation Research, Punjab PWD. "Report on the use of coir as a material for the construction of a tube well strainer."

ERRATA

(Madras Agricultural Journal: April 1956)

Page 155, Para 4, line 4, read as 5000 lb. of green leaf, 150 lb. of ammonium sulphate and 150 lb of superphosphate,

Page 156, Para 2, under. B. line, 4, for figure 25 lb. read as total Nitrogen 55 lb.

Page 157, Para 1, line 1, add "indicate" after "Results".

Preliminary Observations on Jassid Injury in Castor

During the main crop season (July to March) in the years 1954 – '55 and 1955 – '56, a number of castor varieties, inbred types and progenies of crosses were in various stages of trial and observation on the Central Farm, Coimbatore. In both the years, the infestation of green jassids *(Empoasca flavescens)* on the castor crop was very severe and in some of the strains and types, the injury was so pronounced that the entire crop presented a blighted appearance. There were, however, a few types which showed marked resistance to the pest. Between these extremes, types showing intermediate grades in the intensity of jassid attack were also observed. This opportunity was availed of in making a careful assessment of the degree of susceptibility of the various types, and strains, etc. to the pest. On the basis of the observations carried out during the two seasons it was found possible to classify the degree of injury by the pest into the following five clearly distinguishable grades.

Grade of injury	Types	Extent of injury
Highly susceptible (Plate I, Fig. 1–TMV. 1)	TMV. 1, Conner, Italy.	Almost entire leaf, especially older leaves, dried and crumpled up or torn off with only a narrow strip of green adjoining the midribs, remaining in some leaves. Younger leaves drying up partly or completely starting from the margin and and becoming cup-shaped.
Susceptible	Israel, Mauthner's dwarf.	Drying of leaves proceeding from the margin or starting in patches on either side of midribs and coalescing together or forming holes. In younger leaves, dry patches alternating with green portion. The green area remaining unaffected on lamina is more than in highly susceptible types.
Partially susceptible (Plate I, Fig. 2-TMV. 2)	Cimarron, Baker 1, Baker 195, Hindi (Egypt) TMV. 2 strain.	Small, dry spots or patches appearing between veins on either side of midribs, especially on the older leaves. Younger leaves almost free from affection.
Resistant	R. C. 913, 1074, 1075, 1076, TMV. 3 strain.	Nearly free from the leaf symtoms but small dry patches appearing on the older leaves in stray cases.
Highly resistant. (Plate I, Fig. 3-EB. 26)	C. 3 (Pakistan) E.B. 26 (Madhya Pradesh) E.B. 31 (-do- -do-)	Completely free from the leaf symptoms.

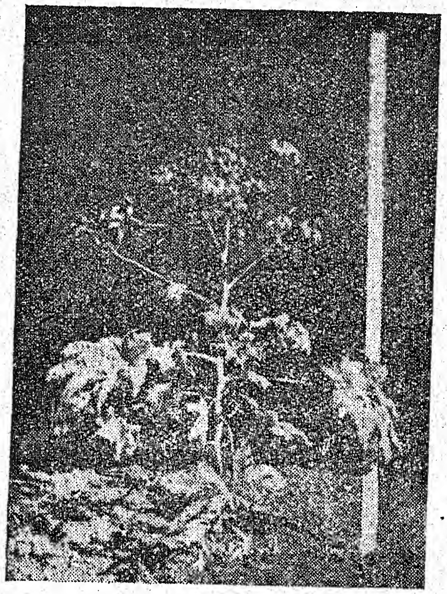


Fig. 1

Fig. 2

Fig. 3

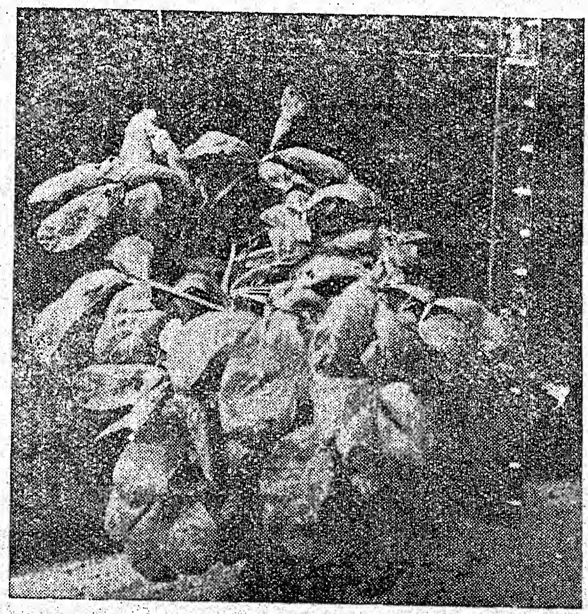
A view of the entire population of castor in the field suggested that types having leaves with covering of waxy bloom are comparatively more resistant to the jassids (the resistance increasing with the intensity of bloom) than those having leaves without bloom. From the behaviour of the progenies in this regard there is reason to believe that susceptiblity to jassid attack may be an inherited character.

These observations will be followed up in greater detail and over a larger range of material and populations for confirmation.

Agrl. College & Research Institute, Coimbatose. } C. R. SESHADRI, K. A. SESHU.

A Mutant Form of Groundnut

In a routine comparative trial of groundnut selections laid out during the monsoon season (July to December of 1955) in the Central Farm, Coimbatore, the authors happened to notice a peculiar form of groundnut in one of the plots of the semi-spreading pure-line A. H. 6615 which is an extract from a cross between 'Spanish Bombay' and 'Native Tanganiyka'. This plant was characterised by a very short stature and abnormally large leaves. A brief type description together with a photograph of the plant is furnished below.



"Habit of growth. - Bunch, with feeble branching; stem - thick, sparsely hairy; light-green tinged with purple; leaflets - very large (8·6 cm x 4·2 cm), oblong-elliptic, green with elliptic, green with light mottling of greenish yellow, a tendency to droop, late flowering (55 days as against 30 days of ordinary type); flower - large orange yellow, papilionaceous; gynophore - thick, purple; pods-large 1 to 2 seeded, distinct beak and veins, shallow constriction, thick shell; kernels - big, rose, oblong, somewhat plump; duration - long (135 days)".

John and others (1954) in their classification of groundnut varieties and forms have described five varieties and twenty-three forms. But the form now spotted out by the authors differ from them not only in its very short stature but also in its abnormally large leaflets which show a tendency to droop and exhibit a greenish-yellow mottling. Considering these peculiar features not already described and classified by previous workers, the authors are inclined to give it the status of a new form of groundnut. As this has occurred spontaneously among other groundnut varieties and forms grown at Coimbatore during 1955 monsoon season, it is presumed to be a mutant.

As the breeding behaviour of this plant and its cyological constitution are not known, it is too early to predict its use in future breeding work. Since the plant has produced only a few pods, estimation of its seed dormancy, oil content, etc. has not been possible. Only when its breeding behaviour and other economic features are known can its future utility be assessed. At present this new form of groundnut is only of academic interest.

Agricultural College and Research Institute, Coimbatore.

C. R. SESHADRI.
K. A. SESHU.

REFERENCES:

C. M. John et. al. (1954) Varieties and forms of groundnut their classification and economic characters - Indian Journal of Agricultural Science, Vol. XXIV, 4.

Selected Article

The Tamarind is Prized for its Shade and Shelter

by

M. D. CHATURVEDI

There are few trees that can equal the tamarind in its generous spread of crown which provides shade and shelter against a tropical sun.

Cultivated widely for its shade and fruit, the tamarind is not a tree of the forest. It occurs freely throughout the country except in the extremely dry western zone. Indigenous to Abyssinia and Central Africa, the tamarind came to be introduced in India (probably by the Arabs) long ago.

Prized for its shade, the tamarind is frequently planted in roadside avenues. Stately tamarind avenues dating back to the days of the Nawab Viziers of Oudh are still to be seen along the arterial roads in Uttar Pradesh.

The tamarind is one of the longest-lived trees. It was for this reason that it was accorded special recognition in mausoleums and in graveyards throughout North India. An avenue in Fyzabad planted by Shuja-ud-Daula in 1765 is still thriving, good and green. A tamarind tree at Kara (Gaya) which measured eight feet in diameter was reported by A. E. Wild. The tamarind attains a height of about 100 feet and a crown spread of 30 to 40 feet.

Growing as it does, throughout the country, the tamarind *Tamarindus indica* is known by various names: *Imli* (Hindi); *Hunase* (Kanarese); *Chinch* (Marathi); *Puli* (Tamil); *Chinta* (Telugu); *Pulinje* (Coorg).

The tamarind is an evergreen tree. In excessively hot and dry regions, it becomes leafless only for a short while. The leaves have a feathery pattern, each tiny leaflet being about half an inch long. The new leaves appear during March–April. The small yellow and red flowers are in evidence throughout the summer. The pods appear during winter and ripen in the Spring (February–March).

Propagation: Individual pods contain about a half a dozen (three to ten) dark–brown, smooth, and compressed seeds covered with an acidic pulp widely used in Indian cookery and indigenous medicine.

The seed germinates well and yields a high plant percentage. By far the best method to raise tamarind seedlings is to sow seed during April in one's vegetable garden in the backyard. The seedlings should be transferred to deep baskets, making an allowance for their long tap-roots, before the onset of the cold weather. These basket plants should be carefully protected from frost during winter and from drought during summer. At the beginning of the following monsoon they should be put out where required.

The tamarind thrives best in deep loamy soils providing optimum conditions for the development of its long tap-root. The tamarind manages to eke out a precarious existence even in the rocky soils of Chota Nagpur and persists along roadsides in Hyderabad State.

Young plants are very frost-tender and throughout the winter need protection; this can be provided best by covering individual seedlings with a cape made out of grass. Although they can stand drought better than frost, it would be best to water the young tamarind plants during their first two summers. The plots should be kept free of weeds. The soil should be hoed at least twice during the winter.

Special protection should be afforded against domestic animals by raising a live hedge of babul all round individual plants when put out in the open.

Uses: The tamarind tree, although comparatively difficult to establish, provides shade, shelter and fruit for 200 to 300 years. It is one of the nicest shade trees for threshing floors, because under its heavy shade, the floor is always clean, and free of all undergrowth.

The wood is hard and close-grained and is used in making agricultural implements, rice pounders, oil mills, and household furniture of all sorts. It yields excellent charcoal which was very much in demand for producer gas units fitted on trucks and cars during the war.

The pod is much in demand for its acidic pulp used in cooking and indigenous medicine as an astringent and aperient.

The seeds yield starch which was very largely used as a sizing material during the World War II according to a process developed at the Forest Research Institute, Dehra Dun.

[Indian Farming, 5. p. 16.]

Weather Review — For April, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	1·5	+ 0·9	2·8
	Tirurkuppam*	1·4	+ 0·7	2·7
	Vellore	0·4	— 0·6	1·3
	Gudiyatham*	0·4	— 0·6	0·9
East Coast	Palur*	1·2	+ 0·1	2·3
	Tindivanam*	1·2	+ 0·2	2·7
	Cuddalore	1·2	+ 0·2	1·9
	Nagapattinam	0·3	— 0 8	2·9
	Aduthurai*	0·9	— 0·3	3·0
	Pattukottai*	Nil	— 2·5	2·6
Central	Salem	0·7	— 1·2	1·1
	Coimbatore (A. M. O.)*	1·7	— 0·8	1·8
	Coimbatore	1·6	J. N.	1·7
	Tiruchirapalli	1.3	— 1·1	1·8

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
South	Madurai	1·0	— 1·2	2·4
	Pamban	0·6	— 1·2	1·2
	Koilpatti*	1·9	— 1·6	3·1
	Palayamcottai	0.2	— 2·3	3·6
	Ambasamudram*	0·2	— 3·7	4·7
West Coast	Trivandrum	5·5	+ 0·9	7·0
	Fort Cochin	12·0	+ 7·1	16·7
	Pattambi*	4·4	+ 1·3	5·5
	Kozhikode	7·1	+ 2·2	8·9
	Taliparamba*	3·3	+ 0·4	3·3
	Wynaad*	6·2	+ 1·2	7·3
	Nileshwar*	4·9	+ 1.9	4·9
	Pilicode*	3·0	— 0·4	3·0
	Mangalore	1·7	— 0·2	1·7
	Kankanady*	1·6	— 0·5	1·6
	Kotekar*	2·4	+ 0·8	£
Hills	Kodaikanal	6·3	+ 1·5	9·6
	Coonoor*	4·0	— 2·0	6·7
	Ootacamund*	5·4	+ 0·7	5·6
	Nanjanad*	3·6	— 1·5	3·8

Note :— 1. * Meteorological Stations of the Madras Agric. Dept.
2. J. N. = Just normal.
3. £ = It is a new station. Raingauge was installed only in March 1956.

The month began with dry weather and sub-normal day temperatures in Tamilnad. This sort of weather prevailed in the first three days except for a very light shower at Shimoga in Mysore. On 4—4—1956 localised showers were received in Travancore-Cochin. Scattered thundershowers were received in Travancore-Cochin State, south Tamilnad and Malabar-South Kanara on 5—4—1956. On 6—4—1956 showers were fairly widespread in Travancore-Cochin and at a few places in interior Tamilnad. Thundershowers became localised on 7—4—1956 in Tamilnad. From 8—4—1956 to 13—4—1956 fairly widespread thundershowers, on some days of a highly localised nature, were received in Travancore-Cochin and at a few places in Tamilnad, invariably in the south. For four days from 14—4—1956 the weather was mainly dry except for very light localised rains in Mysore and at Alleppy. On 18—4—1956 scattered thundershowers were received in Malabar-South Kanara and elsewhere the weather was dry. Localised thundershowers were received on 19—4—1956 in Mysore and at a few places in Travancore-Cochin and adjoining districts of Tamilnad. On 20—4—1956 the weather was dry throughout. A few places in interior Tamilnad and Travancore-Cochin had showers on 21—4—1956. In the next two days localised light thundershowers were received in Travancore-Cochin and at a few places in Tamilnad. On 24—4—1956 a few places in Travancore Cochin and Mysore had some thundershowers. For four days from 25—4—1956 localised thundershowers were received in Travancore Cochin, Malabar-South Kanara and Tamilnad. A cyclonic storm of small extent developed in the west central Bay of Bengal on 29—4—1956 at 08.30 hours, about 120 miles east of Nellore. Under its influence widespread heavy rain, with locally very heavy falls, occurred in Travancore-Cochin, Malabar-South Kanara and Tamilnad. Next

day i. e. on 30—4—1956 this cyclonic storm weakened into a depression centred at 08-30 hours, about 50 miles south of Gadag. Due to this depression widespread, with locally heavy, rains were received in Malabar-South Kanara and Travancore-Cochin.

In the month under report Salem recorded the highest maximum temperature of 104° F on 8—4—1956 and 9—4—1956 and Palghat had 105° F and 104° on 15—4—1956 and 16—4—1956 respectively. Due to sub-normal rains the severity of summer was felt throughout the State with the exception of a few hill stations and portions of the West Coast.

The noteworthy rainfall and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
11/4/56	Alleppey	4·0	North	0·9	+ 0·1	Just above normal
29/4/56	Cochin	6·0	East Coast	0·8	— 0·5	Below normal
do	Trivandram	4·0	Central	1·3	— 0·8	do
do	Punalur	3·0	South	0·8	— 2·0	Far below normal
30/4/56	Kozhikode	3·0	West Coast	4·7	+ 1·3	Above normal
do	Mangalore	2·0	Hills	4·8	— 0·3	Just below normal

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 11—5—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Transfers

Name and present post	Posted as
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Krishna Pillai N., D. A. O. Coimbatore.	D. A. O. Tellicherry.
Thandavarayan K., Supdt. A. R. S. Aduthurai.	Addl. Supdt. C. F. Coimbatore.
Parthasarathy S. V., Sugarcane Specialist, Palur.	Sugarcane Agronomist, Indian Inst. of Sugarcane Res. Lucknow.
Radhakanth P. K., Asst. Agrl. Eng. on leave.	Asst. Agrl. Eng. (Mechanical) D. A's. Office, Madras.
Seshadri C. R., Oil Seed Specialist, Coimbatore.	Headquarters Dy. Director of Agrl., Madras.
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DISTRICTS
S. ARCOT ; COIMBATORE
MALABAR, S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

CROPS
COTTON ; GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Conditions of Commercial Crops in the areas of Market Committees for April, 1956.

I. Cotton : (In this section : Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks : Tirupur : Lint : At Tirupur during the month the lint market opened with a stock of 3636 cdys of Cambodia and 629 cdys of Karunganni. Arrivals during the month amounted to 13,143 cdys of Cambodia and 501 cdys of Karunganni lint inclusive of 4106 cdys of Cambodia and 210 cdys Karunganni lint produced by ginneries. Despatch from Tirupur accounted for 12,792 cdys of Cambodia and 379 cdys of Karunganni lint. These despatches include 2370 cdys of lint sent to Bombay, Travancore-Cochin State, Mysore, Orissa, Madurai, Tirnelveli, Salem, Chingleput,Tiruchirapalli, Tanjore and North Arcot. The month closed with a stock of 3986 cdys of Cambodia and 751 cdys of Karunganni lint at the end of the month.

Kapas : The kapas market at Tirupur opened with a stock of 17,636 pothis of Cambodia and 1978 pothis of Karunganni kapas. During the month 91,600 pothis of Cambodia and 11,659 pothis of Karunganni kapas arrived into the market. These arrivals include 12,204 pothis of kapas received from Salem. Out of the total, 70,969 pothis of Cambodia and 9510 pothis of Karunganni kapas were disposed, and there was a closing stock of 38,267 pothis of Cambodia and 4127 pothis of Karunganni kapas at the end of the month.

Koilpatti : Lint : The market at Koilpatti started with a stock of 33 cdys of Karunganni lint. During the month about 300 cdys of Karunganni lint were received, out of which 250 cdys of Karunganni lint were disposed off locally leaving a closing stock of 83 cdys of Karunganni. There was no stock of Uganda.

Kapas : The kapas market at Koilpatti started with a stock of 500 pothis. About 4000 pothis were received during the month, out of

which 3000 pothis were ginned and disposed off, leaving a closing stock of 1500 pothis.

Ramanathapuram District: Lint: The markets of Virudunagar, Sattur, and Rajapalayam put together opened with stock of 265 cdys lint while the arrivals were 3950 cdys. Disposals during the month amounted to 3850 cdys, leaving a closing stock of 365 cdys at the end of the month.

Kapas: During the month the three markets opened with no stock. Arrivals during the month amounted to 34,500 pothis out of which 32,800 pothis were disposed off, leaving a closing stock of 1700 pothis during the end of the month.

South Arcot District: Kapas: The kapas market started with an opening stock of 16 pothis and only 2 pothis of kapas were received during the month. All the 18 pothis of kapas in stock were despatched to Coimbatore, with nil stock at the end of the month.

Cotton prices: Tiruppur: Lint: The prices of lint were ruling at about the ceilings fixed.

Kapas: The price of kapas was also firm.

Koilpatti: Lint: Prices of Karunganni lint opened at Rs. 830/- to Rs. 856/- per cdy for best quality, and gradually increased to Rs. 845/- to Rs. 856/- at the middle of the month. The prices finally closed firm at Rs. 850/- to Rs. 865/- at the end of the month.

Kapas: During the month prices of Karunganni kapas ruled firm at Rs. 105/- to Rs. 115/- per pothi for average quality.

Ramanathapuram: Lint: The opening and closing values of cotton lint per cdy in all the markets in the district ruled as hereunder.

		Opening:	*Closing:*
Karunganni	...	Rs. 820—846	Rs. 835—846
Tinny Lint	...	Rs. 806—820	Rs. 800—820

Kapas: The opening and closing prices of kapas per pothi in all the markets ruled as follows:

	Opening:	*Closing:*
Karunganni	Rs. 88—106	Rs. 92—106

South Arcot: Kapas: The average price obtained in the market was quoted at Rs. 87—6—0 per pothi.

II. **Cotton Seeds: Koilpatti:** The prices of Karunganni seeds opened at Rs. 35/- to Rs. 37/- per pothi and closed at Rs. 33/- to Rs. 35/- per pothi at the end of the month. The decline in prices is due to moderate arrivals in the market.

Ramanathapuram: The opening and closing prices of cotton seeds were as follows:

	Opening:	*Closing:*
Karunganni Cotton Seeds	Rs. 9-12-0 to 10-0-0	Rs. 10-0-0 to 10-12-0 (per Maund of 82½ lb.)

III. **Groundnut:** (Candy = 531 lb. of kernels. Bag = 80 lb. of pods).

South Arcot: The opening stock, arrivals into the market from other districts and States, disposals and closing stock with trade, markets etc., were as hereunder.

Opening Stock	...	5491 tons.
Arrivals into the nine Market Yards	...	737
Receipts from other districts	...	580
Imports from other States like Andhra	...	152
Consumption by oil mills and country chekkus in the district respectively 2332 and 188 tons	...	2520
Despatches to other districts like Madras and Tanjore	...	494
Exports to other States like Pondicherry	...	74
Closing stock ...	...	3872

The average prices in the several markets ranged from Rs. 142–12–0 to Rs. 159–9–0 per candy according to quality of the produce.

North Arcot: During the month 814 tons of groundnut kernels were received, out of which 351 tons were despatched to other market centres like Madras, Coimbatore, Salem and Chingleput. At the end of the month there was a stock of 1885 tons of pods and 1514 tons of kernal with the merchants.

The prices of kernel ruled at Rs. 158/- to Rs. 160/- per cdy while the pods were quoted at Rs. 15/- to 19/- per bag.

Ramanathapuram: The opening and closing rates of groundnuts in all the markets of the district are quoted as follows:

		Opening:	*Closing:*
Groundnut pods	...	N. A.	N. A.
Groundnut kernels	...	Rs. 160–170	Rs. 150–170 per candy.

IV. **Gingelly : South Arcot District :** (In this section : Bag=168 lb.)

The month opened with a stock of 640 bags. Arrivals of gingelly into only 3 markets amounted to 825 bags. Besides 602 bags were received from other districts like Tiruchirapalli. Out of the total quality, 900 bags were consumed by country chekkus in the district and 713 bags were despatched to other places like Madras, North Arcot and Madurai. The closing stock at the end of the month was 454 bags.

The average prices in several markets varied from Rs. 64/- to Rs. 73-3-0 per bag according to quality.

V. (a) **Coconut :** (In this section : Cdy = 700 lb.)

Coconut ; stocks (In thousands) : The particulars of stocks of coconuts transacted in the districts of Malabar and South Kanara are given below :

Name of the market		Opening balance	Arrivals	Disposals	Closing balance
Kozhikode	...	6,565	4,800	4,300	7,065
Badagara	...	865	1,420	1,412	873
Ponnani	...	600	760	760	600
Tellicherry & Dharmadam	...	674	1,003	1,010	667
Mangalore	...	60	270	275	55

Prices : The minimum and maximum prices of coconuts as between the different markets of Malabar district and South Kanara ranged as follows :

(In Rs. per 1000 nuts)

			Minimum	*Maximum*
Kozhikode		...	Rs. 110	Rs. 120
Ponnani		...	,, 127	,, 135
Badagara		...	,, 95	,, 135
Tellicherry & Dharmadam		...	,, 131	,, 132
Mangalore	Raw		Rs. 122 — 155	Rs. 120—150
do.	Dry		Rs. 150 — 200	Rs. 145—190

Copra : Stocks ; The stock position of copra in Malabar and Mangalore Markets are given below :

Market		Opening stock	Receipts	Disposals	Closing stock
Malabar district:					
Kozhikode	...	5,488	14,500	14,000	5,988
Badagara	...	380	4,908	4,798	490
South Kanara district					
Mangalore	...	95	250	236	109

Prices: The prices of copra as between the different varieties at several markets of Malabar district and South Kanara are as follows:

(Prices in Rs. per candy)

		Kozhikode		*Badagara*	
		Minimum	Maximum	Minimum	Maximum
Office	...	Rs. 290	Rs. 275	Rs. 290	Rs. 280
Edible	...	,, 295	,, 290	,, 295	,, 290
Madras	...	,, 300	,, 295	,, 300	,, 300
Rajpur	...	,, 345	,, 335	,, 325	,, 315

South Kanara District:	Mangalore	
	Minimum.	Maximum.
Mangalore	Rs. 275—295	270—290

VI. **Arecanuts:** (In this section, Bag = 100 lb.)

Stocks: The stock particulars of arecanuts in Malabar and South Kanara districts are given below:

Distrect,		*Opening Stock.*	*Receipts*	*Disposals*	*Closing Stock.*
Malabar District (in bags)					
Kozhikode	...	Nil.	Nil.	Nil.	Nil.
Palghat	...	100	Nil.	40	60
Ponnani	...	300	Nil.	300	Nil.
South Kanara District:					
Mangalore Supari		22,800	29,800	26,348	26,252

Prices: (a) In Palghat market the prices of arecanuts (*choor*) ranged between Rs. 170/- to Rs. 185/- per bag during the month.

At Mangalore market the prices ranges of supari of different varieties during the month were as hereunder.

		(Price in Rs. per cwt.)	
		Minimum	*Maximum*
Koka	...	Rs. 75	Rs. 110
Choor	...	No stock.	
Malabar Supari	...	,, 122	,, 145
Mangalore ,,	...	,, 135	,, 160

VII. **Tobacco:** (In this section: Cdy = 500 lb.)

Stocks: The tobacco market started in Tirupur with an opening balance of 3555 cdys of chewing tobacco. About 50 cdys of beedi tobacco was reported to have been imported during the month. Despatches in the month amounted to 950 cdys chewing variety to places like Palghat, Travancore - Cochin State, Andhra, Tanjore, Tiruchirapalli, North Arcot, South Arcot, Chingleput and Madurai. At the end of the month there was a closing stock of 6280 cdys of chewing tobacco and 1400 cdys of cheroot tobacco.

Prices: The prices of different varieties of tobacco of several grades ruled at the ranges furnished below:

(Prices in Rs. per cdy of 500 lb.)

		I grade	*II grade*	*III grade*
1. *Chewing Tobacco, Sun-cured:*				
Meenampalayam	...	300 — 400	200 — 300	110 — 200
Other varieties	...	295 — 355	200 — 275	115 — 160
2. *Cheroot varieties.*				
Sun-cured (grown in Erode and Bhavani Taluks.)	...	350 — 450	250 — 350	150 — 220
3. *Chewing varieties:*				
Pit-cured (grown in Palladam and Sulur areas.)	...	250 — 350	175 — 250	100 — 150

Review of the Activities of the Market Committees during April 1956

All the Market Committees continued to function during the month. Except the Coimbatore Market Committee which is functioning under an elected body all the other Market Committees are working under their respective Collectors or his nominees under Section 6A of the Act. Necessary steps are continued to be taken to conduct fresh elections of these Committees.

The following progress was made by the Market Committees in the issue of licenses under the provisions of the Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	39	560	55	418	41	233	—	3
South Arcot Market Committee	111	999	82	892	86	826	—	3
Coimbatore Market Committee	130	404	124	443	232	550	1	4
Tirunelveli Market Committee	—	3	—	1	—	—	—	—
Ramanathapuram Market Committee	—	4	—	3	—	—	—	—
Malabar Market Committee	22	231	125	1029	8	152	—	5
South Kanara Market Committee	27	190	23	161	4	55	—	—

II. **Meetings:** A meeting of the Coimbatore Market Committee was held on 18—4—1956 in the Office of the Committee, Tirupur when six subjects were discussed at the meeting. A few of the subjects discussed are furnished below.

(a) Amendment to the schedule (a) Cotton kapas under by-law 28 (viii).

(b) Resolved to re-fix temporarily the cost of Borahs at Re. 1/- each. Thattus at 0-8-0 each and gunnies at 0-5-0 each with effect from 21—4—1956.

(c) The Committee resolved that the prices of the above may be revised from time to time as the market rates for these fluctuate.

III. **Quality appraisal:** 250 samples were drawn for analysis and to decide quality factors from out of 2517 lots comprising of 14,335

bags of groundnut kernels in six markets of the South Arcot Market Committee. The total-common refraction was below 4% in 143 samples, 5 to 8% in 106 samples and above 8% in one sample. The details of analysis which may perhaps be of interest are extracted below:

Particulars	Cuddalore	Villupuram	Tindivanam	Virudhachalam	Panruti	Tirukoilur.
1. Dryage:						
2% and below ..	2	—	4	88	2	3
above 2% and upto 3% ..	10	—	—	5	—	—
above 3% and upto 4% ..	4	—	9	—	—	21
above 4% and upto 5% ..	8	—	13	—	—	—
above 5% and upto 10% ..	16	4	8	—	2	36
above 10% ..	1	2	6	—	—	—
2. Total refraction:						
4% and below ..	22	—	7	68	2	44
above 4% and upto 8% ..	25	5	33	25	2	16
above 8% ..	—	1	—	—	—	—

Regulated Market for Coconuts & Arecanuts at Thalakkadathur near Tirur in Malabar (Opened on 18-3-1956)

The second Regulated Market for coconuts and arecanuts and under the Malabar Market Committee's Five Year Plan of opening 22 regulated Markets was opened at Thalakkadathur in Tirur Taluk on 18-3-1956. Sri K. P. Kesava Menon, Bar-at-Law, Editor, Mathrubhoomi, presided. Owing to the unavoidable absence of Sri R. C. Joseph, Collector of Malabar, who was to inaugurate the market, the inauguration was also done by the President. The State Marketing Officer, Sri M. Obeidullah Shan was also present.

Sri K. Sivasankara Menon, Secretary of the Market Committee, welcomed the gathering.

The secretary in his welcome speech said that it was the second regulated Market that was opened in this district and that the first one was opened at Kuttippuram last year by the Hon'ble Sri M. Bhakthavatsalam, Minister for Agriculture. He stated that the market opened at Thalakkadathur was the second of the 22 regulated markets which will be opened by the close of the Committee's Five Year Plan of opening regulated markets in this district. He also gave a brief description of how transactions are effected in the regulated market and the advantages of having regulated markets. He concluded by requesting the growers and traders of coconuts and and arecanuts to make full use of this new market.

The President in his introductory speech welcomed the opening of a regulated market at Thalakkadathur which is an important centre for coconuts and arecanuts. He spoke of the usefulness of having regulated markets and exhorted the traders and growers of the area to fully co-operate with the market committee to make it a success.

The secretary then read messages received from distinguished invitees.

The President then inaugurated the market by cutting a ribbon. Two losts of coconuts which were brought in the market for sale were auctioned and both the lots were sold to a local licensed trader whose bid was the highest.

The function came to a close with a vote of thanks by Sri M. Balaraman Nair, Senior Inspector of the Committee.

THE MADRAS AGRICULTURAL JOURNAL

Hints to Contributors

The pages of the Madras Agricultural Journal shall be open ordinarily only to the members of the Madras Agricultural Students' Union.

All articles for publication should be addressed to the Editor, Madras Agricultural Journal, Lawley Road P. O , Coimbatore.

In view of the high cost of printing, contributions should be as concise as possible and should conform to the best usage in the leading Journals published in India and abroad.

Manuscripts should be typed with double spacing on one side of the paper only and with wide margin. They should not ordinarily exceed 5,000 words or 12 pages of printed matter including tables and illustrations in the Journal. Manuscripts should be carefully revised; numerical data and calculation checked. Main headings in the text should be typed in capitals with paragraph indentations and followed by a period and two hyphens. Sub-heads should be lower case and be underlined to indicate italics. Latin nomenclature and local terms etc., should be in italics. Original papers must conclude with a summary of not more than 300 words, drawing attention to the main facts and conclusions.

Tables: The number of tables should be restricted to those absolutely necessary, as numerous tables detract from the readability of the article. Each table should be numbered consecutively from 1 up and must have a heading stating its contents clearly and concisely. The tables are to be typed on separate sheets with their positions marked in the text.

Illustrations: Wherever possible illustrations should be made with pen and Indian ink for reproduction as line blocks. The name of the author, title of the article and figure number should be written on the back of each figure in blacklead pencil. Each figure should have a legend typed on a separate sheet.

Photographs: Photographs and wash drawings are more expensive as half-tone blocks are necessary. The cost of blocks is chargeable to the author of the article. Photographs submitted as illustrations should be unmounted, glossy prints of good quality, with strong contrasts, trimmed so as to include only the essential features to be illustrated. They should preferably be of the same size as desired in the printed paper. Photographs should always be packed flat, never rolled or folded.

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References: References and reviews of literature should relate only to closely pertinent papers. The list of references should come at the end of the article, after the summary and should be arranged in alphabetical order of authors' names followed by the year of publication in brackets, and then the title of the paper, name of periodical, volume number in bold face type and then the page number, e. g. Darlingtion C. D., (1944) Heredity, development and infection. *Nature*, **154**; 164-9. Abbreviations for names of journals are to be in the approved form as given in the World List of Periodicals.

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The

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Editorial

"BETTER late than never" and we are therefore glad to publish in this month's issue the papers presented for the symposium on "What next in Agricultural Research and Extension" during the last College Day and Conference, in August 1955. For this, the Union has to be thankful for the generous grant of Rs. 1,000/- sanctioned by the Government of Madras, towards the cost of printing all the papers in a single issue of the Madras Agricultural Journal.

A perusal of the papers would show that in spite of a time-lag of over ten months, none of the papers has lost its topicality, because all the problems mentioned then still exist and the methods of tackling them are also as appropriate now as in August 1955. The first paper by Dr. K. C. Naik gives a critical and masterly survey of the present position in regard to agricultural research, with valuable suggestions for improving the efficiency still further. The second

paper by Sri S. N. Venkataraman is an equally helpful survey in respect of extension work and indicates the lines along which further progress is possible. In the next paper, a brief outline is given of some of the more spectacular of the recent advances in agricultural research, indicating their possibilities for the future. A similar review is made in the next paper on the use of fertilizers. The paper on actinomycetes is an interesting one, as it relates to a field which is virtually untrodden by Indian workers, in spite of its great practical potentialities. Some constructive suggestions are made in the paper by Sri Ibrahim Ali to increase the utility of plant protection work and this is followed by a series of papers on crops, such as Paddy, Millets, Cotton, Oilseeds, Sugarcane and Fruits. The future possibilities of soil research and weather forecasts form the theme of the next two papers and in conclusion some practical suggestions are given in the last two papers, for improving agricultural extension, to take the results of research as it were, right to the very doorstep of every farmer.

What Next in Agricultural Research?

by DR. K. C. NAIK,
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A retrospect of the work done in the field of agricultural research in this State for nearly six decades is bound to present us with a store-house rich with experiences of successes and failures, hopes and frustrations. The monumental "Memoirs of the Madras Agricultural Department" published recently, as well as the "Basic Records of Experimental Work" also compiled recently in each research centre in this State, constitute not merely valuable records of the past achievements, but also a medium to detect many a void or imperfection in our agricultural knowledge and practices. At a time when nationwide attention is being focussed on the outlines of the Second Five-Year Plan, the availability of these factual accounts of the track covered and of the sign-posts for the future is of invaluable benefit to keep us off from paths that may end in a blind alley.

From the administrative angle certain policies have been recently adopted and measures taken in this State, which are also expected to have a profound bearing on the course and content of our agricultural research work in future. The net effect of these has been that the purely administrative and routine duties of our research workers have been eliminated, so that our research personnel are no longer tied down to their office tables and are free to devote their full energies and talents to the work for which alone they were chosen and intended. With the clearing of the deck we have virtually set the stage, therefore, to mingle our efforts with those of others in the country for the next spurt towards the national goal.

The basis of all agricultural research is rooted in the conception that the prevailing crops and cropping practices are capable of considerable improvement. The fact that agricultural crops and cropping practices are not the same in all parts of the country, stands to interdict the use of steam-roller methods either in the research programme or objectives. We have had experience in this State of the projects and trials of horse-drawn implements imported

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from Great Britain, electro-culture methods borrowed from Uttar Pradesh, introduction of milk-yielding trees, etc., which had to be abandoned or had to run their weary course, to confirm the view that borrowed ideas or hypotheses do not always transplant well in a new environment.

The trend towards co-ordinated research is a noticeable development after the establishment of the Indian Council of Agricultural Research and the various Commodity Committees. In the Indian Council of Agricultural Research, the scientific committees are composed only of representatives of technical personnel, and these are charged with the preliminary scrutiny of research projects as well as the detailed scrutiny of technical programmes and reports, while in the Commodity Committees the technical or technological or agricultural research sub-committees are generally made up of both non-officials and technical personnel. It is possible that the association of non-official elements in these Scientific Committees may help the former to gather an idea of the work under way, but it is a moot point if their co-operation is essential in the scrutiny of these technical programmes and reports, to judge the soundness of the technique, appropriateness of the analysis of data or the validity of inferences in the progress reports.

The promotion of research through Central and Regional Research Stations being one of the primary objectives of these Commodity Committees, a substantial fillip has been given in recent years to the establishment of a network of research centres by these Commodity Committees either on their own initiative and resources or with the collaboration elicited from the State Governments. While all these are apparently to the benefit of the country, a question may be raised as to whether there has been a corresponding upgrading in the standard of research, and therefore, in the net contribution through research to the welfare of the country. Co-ordination to be effective and efficient has necessarily to embrace all technical work on subjects or crops which are allied in so far as techniques are concerned. If the research programmes and reports on crops and subjects requiring similar techniques are dealt with by independent bodies, and the research projects on allied problems are tackled in centres totally unconnected with each other, though at times situated near to each other, there is the danger of overlapping activities or the emergence of conflicts, which are not conducive to research, especially in schemes for which provision exists only for the appointment of juniors on the lowest scales of pay.

No research programme or project can ever reach the requisite standard if assigned to persons living in a subsistence wage level, even while high attainments and qualifications are expected of them. These, as well as the uncertainty of tenure which characterises the research posts associated with a number of research projects, may not help to attract the best talents to the scientific fields. Difference in emoluments and prospects as between the research personnel in the States and the Commodity Committees or the Central Government or as between the technical personnel of these bodies and those engaged by Agricultural Departments in the same State and working at times in the same town, may also have repercussions on the morale of the less fortunate sections of our public service, at the same time shutting out the best of the country's talents from the research fields in the States. Upgrading of research may require, therefore, not merely organisational changes but also a change in the service conditions of research personnel at all levels.

With the establishment of the Indian Council of Agricultural Research and Commodity Committees, the State Governments have been left to cater to their research projects through the aids to be obtained under certain specified conditions for temporary periods from these central bodies. Naturally enough, this may tend to induce the States to think of only local problems as distinct from extra-State problems or fundamental research. An accentuation of the awareness of administrative divisions rather than the universality of science or the fundamental requirements of the country as a whole is a feature that has to be prevented. Any change in our agricultural research set-up has necessarily to consider these features, so that fundamental research which is the life-giving stream for applied research as well as for regional or national interests, are not allowed to become the victims in the clash of ideals, and excessive stress on local or other extra-scientific problems may not at times simmer and froth over the larger interests of the country.

That research cannot be restricted to a groove, either in the sense of space or in terms of restriction of knowledge, is axiomatic. When research projects and programmes are shaped with the knowledge gained in a particular centre or region, the scope, standard, efficiency and applicability of research are narrowed down to the level of the mental horizon of those who have shaped the project or programmes. The Scientific Committees of the Indian Council of Agricultural Research are intended to out across such inhibitions and

restrictions, but these Committees can effectively discharge their functions only if they are free from the domination of loyalties other than to science. The constitution of these scientific committees firstly on a regional basis, and then, at the ultimate national level, with the representatives of the best available talent, may be a pre-requisite for neutralising these extra loyalties and affiliations, though the ultimate discussion on the committees' recommendations and the acceptance of the same may rest with the appropriate bodies composed of both official and non-official representatives. Thus, while a thorough discussion by all the concerned authorities and public representatives is guaranteed, full freedom for a scientific approach and scrutiny both on a regional and national basis is also ensured by the arrangement suggested above.

In respect of most of the agricultural crops grown in this country, rainfed cultivation continues to be dominating feature. Evolution of hardy, drought-resistant, high-yielding, quality strains to suit the eminently risky conditions of culture of unirrigated crops has not been commensurate with our requirements in the past. Such work entails the need to comb the wilds, semi-wilds, and the vast unirrigated regions of cultivation for spotting out material with a wide array of desirable attributes. Explorations of regions outside the country and examination of the collections maintained in breeding centres elsewhere may also be helpful and even necessary, if a comprehensive, economic and fruitful approach is intended. As it is, when such work is handled by a multiplicity of State agencies, generally with meagre resources, the net result may be a partial approach that may lead to misleading indications. All these deserve to be replaced by co-ordinated action in the field of agricultural research.

The system of conducting crop research in the States with their generally meagre resources and with similarity of a host of problems, may inevitably lead to the tagging of research on crops of diverse peculiarities to a single agency in some of the States. This may further limit the possibility of pursuing research at the highest possible standard in respect of all such crops and subjects. Meagre, piecemeal and part-time attention at a multiplicity of centres on crops and subjects of diverse requirements may not only be prejudicial to the interests of research but it may also generate a false sense of feeling that all what is possible is being done for research.

According to the present practice, release of improved strains is being effected in each State after certain tests in cultivators' lands. The procedure adopted in the conduct of these tests is not always standardised. Scattered block trials are taken up in some cases,

while for others only rough observational trials are conducted. In any case, ryots' fields chosen at a few places cannot be the best medium for affording a reliable clue. It can never be as reliable as tests conducted under a standard plan in stations located in all the typical regions and in every soil-climatic zone, under standard agronomic practices. This is the system followed in Japan and can well be emulated by us. The plea that our Government farms are not representative of ryots' holdings seems to be a worn-out plea. Firstly, the ryots' land is not a static conception. It has to improve and it has improved greatly in recent years. What we have to aim is to improve the pattern of cultivation and have our improved strains ready to suit such improved conditions. We do not have to try our strains under primitive conditions, as that would mean our acceptance of the view that Indian agriculture will be always primitive.

One of the greatest evils in research to be guarded against, is the contingency of its degenerating to a mere routine, such as testing of a few methods or practices copied from elsewhere or of a few proprietory substances, or aimless crop selections from any available bulk. Though such an eventuality may be a remote one, it is by no means unexpected when the facilities provided for research are meagre and the personnel insufficient or ill-equipped. To wrench oneself from old moorings and traditions is often as difficult for a scientist as for a layman. The solution to all such problems is a bold policy whereby research is conceived, planned and built up on a scale to enlist the best of the nation's talent to work under a system of unified and co-ordinated guidance with ample facilities for both fundamental and applied research to suit the needs of every region, free from all unnatural restrictions such as those imposed by State barriers.

Methods and policies being of crucial importance for the improvement and success of the future of agricultural research in this State and in the country, it has been found necessary to dwell at some length on a few of the more outstanding features of the prevailing system. As important as any of these is the delineation of problems in all branches of agricultural research, which deserve attention in the immediate and distant future. This is a matter on which the Crop and Subject Specialists are expected to, and should rightfully give the lead. In the present note no endeavour is made to anticipate these recommendations or suggestions of the Crop and Subject Specialists.

What Next in Agricultural Extension?

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In considering the future for agricultural extension work in the Madras State as well as in India it is well to remember that in the next five years the whole country will be organised in the Community and National Extension Blocks. In the Madras State 498 such Blocks will be spread over the entire State. The impact of these Blocks on agricultural extension work has also to be considered. It is well to emphasise that so far as agricultural extension is concerned it is very necessary that in these Blocks work should be on a more and more intensified character and on a much larger scale, with increased agricultural production, as well as improvement of agricultural standards.

There are many aspects of agricultural extension work which are receiving attention in greater detail in these days. The Government of India have sent out a few teams under the Indo-American Programme to make recommendations regarding the steps to be taken for the co-ordination of agricultural research and agricultural extension. Unlike in other countries where agricultural extension is largely devoted to education of the ryots, in India the problem is to spread agricultural improvement on a mass scale among a class the bulk of whom are illiterate. The problem, therefore, is one of work in these areas so that the intensified effect on agricultural extension work is brought home to every field, as well as every villager. As the work of agricultural extension is more important, I propose to confine myself here with its essential features apart from any administrative or patterns which may be employed, since the actual work is the most important and requires the utmost attention. In considering work, it may be relevant to consider what has been achieved and what more can be achieved. In Madras State, due to a number of reasons consequent on the need for intensified production to meet the deficits, there has been expansion in many lines of activities. At present, improved strains of paddy has spread over 2½ million acres or 44% of the area. *Sesbania* as

a green manure has spread from a practically negligible area to nearly 1·4 million acres. The consumption of ammonium sulphate has increased from 25,000 tons five years ago, to nearly 75,000 tons. Improved strains of cotton have occupied about 5.3 lakhs of acres or 63% of the total cropped area. In millets the progress has not been much. We have achieved only about eight lakhs of acres, which is less than 16% of the total millet area. In groundnut also, progress has been only about 15% or three lakhs of acres. In sugarcane the effect has been phenomenal, as 95% of the area or about 1,10,000 acres are under improved varieties.

With this background of achievement, it may be possible to plan for the future with a specific object of meeting the needs of the State as well as of the Nation. In the Second Five Year Plan, the deficit of foodgrains in the Madras State has been estimated at about 7 lakhs of tons, and it will be our endeavour in the short period of five years to completely wipe out this deficit. For this purpose, it is very necessary that the area under improved strains should be increased from 2·5 to 5·1 million acres or nearly 80% of the area. In millets where the progress has been much less it is necessary to increase the area from about 8 lakhs of acres to 2·6 million acres. The supplies of ammonium sulphate to food crops has to be increased from 60,000 tons to one lakh and fifty thousand tons and to all crops to 1,75,000 tons. In addition, as organic matter is the most important and cheapest way of adding fertility to the soil, it is necessary to increase the area under green manure, *Sesbania*, from 1·5 to 2·5 million acres. The production of oilseeds has further to increase by 1,30,000 tons in the plan period and of cotton by one lakh of bales, while sugarcane production has to be increased by ten lakhs of tons on the assumption that about eight factories proposed will come into operation.

All these require much careful planning, as well as high efficiency in the execution of work. For this purpose it is necessary that the method of extension should be so adapted and the work co-ordinated so that the largest possible result can be utilised in the smallest time. The most important items in this respect are the supply of seeds, manures, and irrigation resources by mechanical means or otherwise.

The extent to which these methods have been adopted and are to be adopted in future are indicated below:—

To cover an increased area of nearly 2½ million acres under paddy and 2 millions under millets it will be necessary at the end

of the plan period to organise distribution for over 90,000 tons of paddy and millets over 12,000 tons. Several methods of seed distribution have been evolved in the past, in multiplying seeds from the nucleus stage on to the producer. Formerly we used to supply every year 1,000 to 1,500 tons of primary seed from seed farms to be multiplied and to 6,000 or 7,000 tons of secondary seeds to be distributed to ryots. This method involved not only the handling of considerable quantity of seed, stocking and financial difficulties, but it was found that beyond a certain stage extension was comparatively slow. In order to get over the difficulty, a new plan has been introduced in the Madras State, whereby each village will have its own seed farm to cover the entire area in the next year by primary seed as every pound of seed can be multiplied about 40 to 50 times. A quantity of primary seed equal to one pound per acre of the village area is distributed in the village itself in order to cover the whole area by the next year. The multiplied seed is not procured but exchanged immediately with bulk seed from other ryots, through the Village Associations, of which there are about 16,200 established in the Madras State. During the first year of the operation, it was possible to cover about 7,000 villages for paddy and about 2,000 villages for millets under this scheme. In the coming years it is necessary that the entire State is covered with Village Seed Farm seeds, i. e. about 20,000 villages in the Second Five Year plan period. It should be the endeavour of all agricultural extension workers, both in the Community and National Extension Blocks and outside to see that every important village is covered with improved seeds of paddy and millets from the Village Seed Farm. Equally important is the application of manure. If the supply of ammonium sulphate is pushed up to 1,50,000 tons, the increased production will be about 3,00,000 tons of rice, which is quite substantial. Ammonium sulphate is comparatively costly and its application is decided by economic considerations. It is, therefore, necessary to have also a cheap manure, and particularly so as South Indian soils require organic manure in large quantities, especially paddy lands. The future expansion in this respect is to cover nearly 2½ million acres with *Sesbania* as against 1½ million acres at present. Of all green manures tried, *Sesbania* has been found to be the cheapest. As a line crop it gives upto 5,000 lb. of green leaf per acre closely planted around borders of paddy fields and it is enough to manure the field, the cost being hardly one anna per acre for seed. Besides, as a pure crop, *Sesbania* gives about

50,000 lb., enough to cover ten times the paddy area, and this is also economical. But *Sesbania* is an annual crop. It is further necessary to have a permanent arrangement for supply of organic matter in the form of green leaf. For this purpose, *Gliricidia maculata* or *Indigofera teysmanii* planted on the high borders and bunds of the field have been found very efficacious, giving two cuttings per year, enough to manure that area under paddy. The area under *Gliricidia* has expanded from a very small beginnings five years ago, to nearly 40,000 acres at present and the total area so far covered is nearly a lakh of acres. It should be our endeavour to see that by the next five years another lakh of acres is covered, so that the problem of supply of organic matter is solved and a permanent supply of green leaf is assured on a large scale. Altogether, the green-leaf programme gives about 10% to 15% extra yield in paddy and estimated to give permanent increased produc- by 1,34,000 tons of rice at comparatively very little cost to the ryot by the end of the Second Year Plan.

It is necessary in agricultural work to have some easy methods of approach to the ryots and intimate contact is required, and it is for this purpose the Department has organised Village Associations in every village. There are now about 16,200 associations so formed, in the State as against a total of 20,000 villages. The next and most important step in this connection is to make these associations work efficiently, so that they form a compact medium for the spread of agricultural improvements in each village by discussion amongst themselves and with local officers of the Agricultural Department. They should be made to work as media for communicating requirements in seeds, manures etc. required for each village and also for other improvements like introduction of new plants, implements, horticulture and other improved cultivation practices. Apart from other types of village organisations it is found that such an organisation devoted more or less exclusively to the agricultural improvements and extension in each village serves a more useful purpose rather than a generalised organisation. In the future, for extension work these organisations will be made to work in its fullest capacity. There have been discussions about the way in which the ryot is to be approached in regard to agricultural improvements. There are also differences of opinion in this connection as methods of foreign countries are also freely discussed for adoption. It is, however, well to remember in this

connection that the pattern of agricultural extension is to be developed to suit the needs of each locality, particularly in Madras State, where a large body of ryots are illiterate, and have only small holdings. It is necessary to have a direct and factual approach to the actual needs of crop. In this respect personal contact is the most important, and it is that which has to be developed to the fullest extent.

Unfortunately the area covered by each extension worker is comparatively large; roughly it worked to about 1,00,000 acres in the year 1953. From December 1954 the Department has been re-organised to have a demonstrator with a depot and complementary staff for every two firkas and adding the staff employed in the Community and National Extension Blocks, the present area to be covered by an Agricultural Demonstrator is something like 70,000 acres.

It is understood that the area is about the size of a county in Tennessee, which acts as an extension centre for that area. In Madras we have for each Demonstrator a jurisdiction more or less akin to the Tennessee University. Our methods should, therefore, be adapted to the jurisdiction of each agricultural extension worker. A new method was tried in the National Extension Block in Tanjore District where a demonstrator was employed for every firka or about 30,000 acres. The result was that it is possible to extend agricultural improvement practically throughout the area even in the first two years of working. It has been possible to extend green manures over 60% of the area, Village Associations in every village and improved strains in nearly 70% of the area; the intention being that the entire area should be covered in the course of three years. With the introduction of 498 Community and National Extension Blocks in the Second Five-Year Plan, it may be possible to have for each Demonstrator a jurisdiction of the order of 30,000 acres, with greater intensification of work. But one thing is necessary and that is the intensive programme already being carried on should be on a much more amplified scale in these Blocks. For this purpose, it is very necessary to have technical supervision of the highest order.

A further development which has been proposed in the All-India Second Five-Year Plan is the intensification of seed multiplication. It has been proposed to have in Madras about 500 seed-farm blocks of 25 acres each in areas contiguous to

Community Projects and National Extension areas. With these additional 12,500 acres exclusively devoted for multiplication of pure seed, it may be possible to have a large quantity of pure seeds which can be used for every crop to be developed for expansion in the Village Seed Farms in the whole cultivated area. This will be a great step in the improvement, as the Department will then produce the entire requirement of nucleus seed.

A further step contemplated in the Second Five-Year Plan is the introduction of plant protection centres in four places in the State where complete equipment with 400 sprayers, 400 dusters and power sprayers will be available for large-scale operations. It is possible that the Government of India will also be starting one regional plant protection centre for operations against pests and diseases for large-scale use, including aeroplanes. The present work of plant protection covers about 300,000 acres every year, in addition to a large number of fruit plants. In order to take efficient and prompt action in advance, before the pest or disease breaks out in any serious manner we are having in Madras State a weekly forecast of pests and diseases which are likely to occur or which have occurred and are likely to spread in some areas. This information is broadcast through the Radio. It is necessary that the fullest use is made of this information and plant protection measures taken in this State sufficiently in advance, so that the damage by pests and diseases is minimised to the fullest extent possible.

With a view to help the ryots with a permanent source of supply of water, and to help the existing sources of irrigation, the Agricultural Department launched the filter-point scheme. So far about 1,873 filter points have been sunk. In areas with a sandy sub-stratum. The programme is to increase this by 2,000 filter points in the year 1955–56, and another 3,000 in the Second Five-Year Plan, altogether 6,900 filter points capable of irrigating permanently about 69,000 acres would be available in Madras at the end of the Five-Year Plan period, A cheap coir filter point, costing only one-sixth of the ordinary brass filter, has also been devised and introduced. This work on filter points should be pushed through, as it forms an entirely new source of supplementing the existing water supplies and enables raising of crops even in summer, where other sources fail.

I have so far discussed the most important features of agricultural extension in the Madras State in relation to actual

requirements of work and what can be achieved. It will be very difficult to formulate or forecast what changes may occur in the pattern of the organisation for extension work or in the methods of approach, but it should be such that the requirements of ryots are individually met from field to field, aud it should be our endeavour to see that each ryot is made to know and carry out all improvements possible. Personal contact is most important in this respect. If the programme I have just indicated of Agricultural Extension work on the production and improvement side is carried out with vigour, it will be a great improvement in the future of agriculture in Madras State, whatever the pattern or set-up may be in the organisation employed.

Recent Advances and Possibilities in Agricultural Research

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The title in no way implies any disparagement of extension or publicity work, but merely wishes to emphasise the need for more and better research. There is an old saying in Tamil "You can take up in the ladle, only what is left in the pot" and it is the primary duty of every research worker to do his bit in keeping the pot always full.

As mentioned in the Memoirs of the Agricultural Department, there is a real need for a constant examination of the programme of research and developmental work to meet the changing needs of the country from time to time. The memoirs, a substantial volume of which was recently published, serves as a convenient review of the work done so far, i. e. till 1948, but it is already more or less out-dated by the recent developments and achievements, even in our own department.

Agricultural research is a vast field of many specialised sciences, which have all one common object, of improving crop production. There is of course never any doubt about such research being essential, but what is not always remembered is that it should also be quite a continuous process and there can never be a stage when one can rest on his oars and allow the current of publicity to carry him through. It is obviously impossible to exhaust or even to indicate the possible lines of development in all fields of agricultural research, and so the present paper will merely outline the scope for further knowledge in just a few aspects.

Agricultural Research may be grouped into five main classes:

(1) Agronomic,
(2) Genetic,
(3) Chemical,
(4) Physiological and
(5) Pathological.

(1) *Agronomic:* Tillage and other cultural operations, spacing and rotation of crops come in this class.

(2) *Genetic:* These include fundamental cytological studies, hybridisation work, both inter-specific and intra-specific and subsequent selection and fixation of desirable pure types, followed by trials to assess the yielding potentialities, culminating in the evolution of improved strains and varieties.

(3) *Chemical:* All studies relating to plant nutrition, the availability of nutrient elements in different soils, their uptake by crop plants under different seasonal conditions and systems of cropping, the inter-relations of nutrients within the plant system, how best to detect, determine and rectify nutrient deficiencies, and the formulation of optimum fertilizing schedules for various crops; all these come under this head.

In recent times the importance of micro-nutrients is being recognised, not only in maintaining proper growth but also in regard to the possibilities of utilising them to increase productivity as well.

As one of the incidental benefits, (though as yet only to a very small extent) of the armaments race in atomic weapons, we may mention the use of radioactive isotopes in the study of plant nutrition problems. In the more advanced countries of the West and even in the East - (as in Japan for instance), these "tagged" elements are being utilised to trace the paths of uptake of nutrients like phosphorus, in crop plants at different stages of growth and very valuable information has already been secured. Thus, by using radioactive P^{32} it is found 80% of the total uptake of phosphorus by wheat plants was from the added fertilizer and only 20% was taken up from the soil reserves. The phosphorus also gets transferred from leaves and stems into the earheads as the plants mature. Another valuable observation was that fertilized plants are able to take up more of soil phosphorus than unfertilized plants. The ability to utilise soil phosphorus varies with different crop-plants ; thus tomato seedlings are unable to utilise the *P* "fixed" in soils, whereas other crops like Sudan grass could utilize a certain proportion of the soil-fixed phosphorus.

Radioactive isotopes are also useful in determining root development and zones of active root growth in plants far more rapidly than was ever possible by the older imbibition methods. Radioactive Nitrogen (N^{15}) has been useful in nitrogen fixation

studies and (C^{14}) is used in photosynthetic researches and carbohydrate metabolism. As another interesting use of radioactive isotopes may be cited the finding that lemon juice was the most active of all substances tested, to remove phosphorus residues from the teeth, although the actual pH of the fruit juice or of any other mouthwash had very little effect upon the phosphorus depletion from teeth.

From the narrow chemical viewpoint, we may cite as recent advances, the use of liquid ammonia and urea as nitrogen fertilizers, various new methods of making rock phosphate more easily utilizable by plants, and a spurt of research on soil conditioners. the best-known being Krilium. Similar ion-exchange resins have recently gained prominence in de-salting brackish water and thereby even for reclamation of saline and alkaline soils.

In analytical methods, some of the older tools have been improved and perfected as in spectrochemical research. Among the newer tools should be mentioned chromatography, in the detection and estimation of numerous plant products ranging from amino-acids to growth-hormones, in even very small quantities of plant material. The use of labour-saving devices and standardised methods in Western laboratories enables them to handle analytical samples nearly 4 to 5 times what we are able to get through in our laboratories. These devices are simple and relatively inexpensive and need only some thought and skill.

The purpose of the foregoing list is merely to stress the fact that we in South India have a very long way to go before we can expect to emulate the tempo and output of research that exists in other countries. There is also a very great and urgent need to carry out adequate soil-nutrient surveys in different tracts and regions in the Madras State, in order to plan manurial experiments in a more intelligent and purposeful manner, wherefrom better results may be expected in quicker time.

(4) *Plant Physiology:* Being a sort of border-land science it is rather difficult to demarcate where exactly plant chemistry ends and physiology begins, and hence the present distinction is chiefly one of convenience.

Thus the problem of nutrient deficiencies in crop plants is one that is being tackled in other countries both by the chemist and the plant physiologist. When the shortage of nutrient elements falls below a certain critical level the plant develops a characteristic

pattern of visual symptoms on the foliage and other parts of the plant and very often these are known by the term of physiological diseases or physiological disorders. As typical examples we may cite "frenching" or "little leaf disease" on various fruit trees caused by zinc deficiency and "die back" due to copper deficiency. Before these deficiencies get acute, there is usually a preliminary symptomless stage, which is detectable only by careful chemical analysis.

The usual methods of correcting such "deficiency disorders" are by supplying the deficient nutrients in a suitable form and manner, either as soil dressings or foliar sprays, or by injection methods. In view of the complexities of physiological balance and interrelations between different nutrient elements, whereby an excess of one element leads to deficiency symptoms of another element (e. g. Manganese toxicity stimulating iron chlorosis] symptoms and Magnesium deficiency being induced by excess of potash manuring) a great deal of systematic and painstaking research is necessary before we can suggest remedial measures for our South Indian crops and conditions. Here again, there is a real need to carry out adequate soil-nutrient surveys over the entire State as has been done in Australia, New Zealand and many other countries, so that we may be able to programme and test out various remedial measures, before recommending suitable remedies for general adoption.

Growth Hormones: A very wide variety of quite remarkable effects have been obtained in recent years on plant growth and development, by the use of chemicals that go by the name of growth-regulating substances. To recount only a few of these effects, we may cite weed control by selective herbicides, induction of better rooting in cuttings, prevention of fruit-shedding, (e. g. Button-shedding in coconut), improvement of fruit-set, induction of seedless fruiting as in tomatoes, prolonging dormancy in tubers (like potatoes) as well as breaking the dormancy when needed for planting purposes, regulation of flowering and fruiting as in pineapples, to stagger the ripening and thereby prolong the fruiting season, hastening the ripening of fruits like bananas and citrus and prevention of cold storage disorders like "Brown spot" etc.; these are some of the remarkable effects obtainable. Some of these chemicals, like benzatriazole for example, causes a breakdown of apical dominance and induces extensive morphological modifications in the leaves and leafstalks - but this occurs only when the chemical is applied to the soil in which the plants are growing; as foliar applications, even at very high concentrations upto 1000 p. p. m. have no effect at all.

Obviously a vast field of research lies here, wherefrom practical results may be expected in a number of aspects closely related to increased crop production.

The problem of drought resistance is of very great importance in crop production, but it must be admitted that we are no nearer any solution to this problem as yet, because in spite of considerable study in various countries we do not have any recognised or generally applicable criterion for an objective assessment of drought resistance. In view of its complexity, real progress may be expected only after intensive studies are carried out under rigid control of environmental conditions like moisture, light, and temperature, and internal factors like nutrient levels etc.

5. *Pathology:* The same is the position with regard to disease-resistance. This takes us on to the next group. Both against insect pests and fungus diseases we have in recent years developed a variety of chemicals that are more effective than the traditional old-time remedies of Bordeaux mixture and fish-oil sprays, but here again there still exists a real need to intensify research. The scope and possibilities of systemic insecticides against insect pests of the stem-boring type, the interrelations between different pests (e.g. mites increasing when jassids on *Bhendi* are reduced by D. D. T.), these require a good deal more of study.

Against fungus diseases like paddy blast, the search for resistant strains is a continuous one and we are still only on the fringe of the subject.

In the field of virus research we have hardly any information, beyond perhaps the occurrence of such virus diseases on specific crops. Advances in protein chemistry and the electron microscope are being put to use in other countries to investigate virus diseases, but in India and South India in particular, we have yet to make up a time-lag of nearly thirty years.

Fertilizers

by S. VENKATACHALAM &
DR. A. MARIAKULANDAI

Introduction: It is a well-known fact that in India, the population is steadily going up, while the productivity of the land is going down. It is this sorrowful state of affairs that leads our country to the verge of starvation at critical times as in world wars or famine. There is only one way of putting an end to this and that is by ensuring an increase in the yield per acre of our lands, through the use of fertilizers. Fertilizers alone can save us from famines.

Fertilizer production in India: The need for the use of fertilizers becomes clear in view of the insufficiency of available organics such as cattle manure and composts. The use of green manures is limited to soils which are fertile enough to support a green manure crop. In poor soils newly brought under cultivation as in the Lower Bhavani area, a good crop of green manure cannot be obtained unless nutrients are supplied to the soil. Supplying readily available nutrients to the hundred thousand acres is possible only in the form of artificials.

Our country is far behind all other civilised nations in the production and use of fertilisers. A glance at the figures relating to the consumption of chemical fertilisers in various countries of the world is enough to show that acre-yields of crops runs somewhat parallel to the consumption of fertilisers. In our country the production of fertiliser is not sufficient even to meet the present low demands. More factories for the production of nitrogenous and phosphatic fertilisers are needed. The use of fertilisers also has to be considerably stepped up. The following table shows a comparison of Indian production and consumption of fertilisers with that of Japan (F. A. O. Statistics, 1952). Factories as at Sindri have to be established in other parts of the country, and particularly in the South. The Trichinopoly deposits of phosphates have to be exploited for the production of fertilizers like silicophosphates and phosphoric acid.

Table showing the production and consumption of fertilizers in India and Japan

	Production		Consumption	
	India	Japan	India	Japan
	(In 1000 metric tons)			
Nitrogenous — as N	38	457	63	442
Phosphatic — as P_2O_5	13	285	13	243
Potassic — as K_2O	...	4·4	...	9·6

Profitable use of fertilisers: A review of manurial trials conducted in our State and the extensive soil surveys go to show that the requirements of our State with regard to manurial constituents are organic matter, nitrogen and phosphoric acid and for the best results, the artificials are to be used in conjunction with organics. Experiments on ryot's fields in Tanjore delta has also proved that the use of artificial nitrogen alone is not good enough and a combination of nitrogen and phosphoric acid is essential for maximum benefits.

One of the important factors in the efficient use of fertilisers is knowing how much to use and when, for a given type of soil. Of the many methods developed to determine this, the most practical one is the rapid tissue test. The procedure involved is very simple. Nitrogen is tested by adding a few drops of the nitrate reagent directly on the plant on the freshly cut tissue and the formation of a blue colour and its intensity are noted. Phosphate is tested by adding the phosphate reagents to freshly-cut tissue and the intensity of blue colour noted. These tests, though by themselves they are simple, require experience in interpreting the results. In a thorough study, tests can be made on plants from plots receiving known doses of nutrients and results of tests compared with yield figures as shown below:

Level of nutrients	0	1	2	3	4
Results of tests	0	low	medium	high	V. high
Yield	20	40	60	80	80

From the above results it is clear that to get maximum yield, nutrients at level 3 has to be applied and the test indicating High will be necessary. Level 4 can be avoided and to that extent the use of fertiliser can be minimized. Where a systematic experiment is not

possible, tests can be made on the current crops and approximate doses of nutrients can be added. The yield data obtained therefrom can be compared with the results of tests and the experience so gained can be used for the future. A certain amount of standardisation is also required for the different crops to derive maximum benefit from these tests, as the critical stage of crop growth at which tests can be made with advantage and the part of the plant that is best suited differ from crop to crop. Such standardisations are being attempted in the chemistry section of this Institute.

In planning for the future for the use of fertilisers, importance should be given for such field tests and testing outfits. The TCM soil testing in which mobile units are to be used is a welcome step in this direction. Encouragement should be given to the production of handy kits that can be carried on cycles, as is done in Japan.

Newer types of fertilisers and newer techniques for fertiliser use: Technological advances and commercial developments in the field of fertilisers have outstripped expectations and have now become major factors affecting the very destiny of mankind. This was one of the factors missing from the calculations of Malthusian disciples. Synthetic nitrogen materials of low solubility in water such as urea-formaldehyde type is likely to reduce the bill on nitrogen fertilisers. Liquid fertilizers with low vapour pressure such as liquid urea, ammonium nitrate are being produced. Spray applications of urea are already becoming popular. In the field of phosphates, newer types of material such as fused phosphates and silico-phosphates are being produced. Special types of mixed fertilizers (i) to meet specific needs of certain soils or crops (ii) for use with irrigation systems, sprayers or transplanting machines (iii) for use in culture solutions, fish ponds or home gardens and (iv) to combine fertilizer action with the control of weeds, insects, fungi and other pests have been developed.

Fertilizers for certain soils: In the absence of adequate soil-liming programmes, high yields of crops in the humid regions are not favoured. Under these conditions non acid-forming mixed fertilizers are used. Dolomite is generally included along with the acid-forming fertilizers such as ammonium sulphate and ammonium nitrate. For alkali soils, free sulphur is included in the acid-forming mixed fertilizers in addition to ammonium sulphate. For peat and muck soils which are often deficient in one or more of the trace elements, the trace elements are included in the mixtures.

Fertilizers for certain crops: Tobacco, legumes, potato, citrus etc., have specific needs for which special fertilizer mixtures have been developed. Thus tobacco fertilizers average much higher in MgO. and soluble nitrogen. For legumes mixed fertilizers containing P_2O_5 and K_2O, but no nitrogen and ground limestone to render them alkaline in reaction are designed. (Jacob 1952)

Liquid fertilizers: Advantage can be taken of liquid fertilizers such as aqua ammonia, phosphoric acid, aqueous ammonium nitrate etc., for use in irrigation systems. These are cheaper than the salts. In Western United States, liquid ammonia from steel cylinders is commonly applied to irrigation water on a service basis. (precipitaion of salts from the water can be prevented by applying a few parts per million of sodium hexametaphosphate to the water upstream). Liquid mixed fertilizers which have a low pH can be used on alkaline soils with advantage. (Jacob 1952)

The use of fertilizers for spray application and seed treatments hold promise. Treatment of seeds with 5% solution of dipotassium phosphate has given increased yields. Grass seeds spread in a mat of decomposable vegetable matter impregnated with fertilizers is marketted in rolls 20 feet long and 21/2 feet wide in U. S. A. This means of preparing lawn is said to prevent birds from eating the seed, to decrease soil erosion and to assure the purchaser of proper fertilization of the grass.

Herbicidal, fungicidal and pesticidal mixtures of fertilizers: Advantage can be taken of certain fertiliser materials that may serve not only as s source of nutrient but also to eradicate weeds or prevent the growth of fungi. Urea, calcium cyanamide etc., fall in this class. So also, some material used primarily to control weeds, insects or plant diseases also supply nutrients. Bordeaux mixture, borax, zinc chloride are among such fungicides. Certain recently developed pesticides for soil application are effective at rates of less than one lb per acre when they are placed in the seed or root zone of a crop. An example is the commonly known 2–4, D which kills the broad-leaved plants but are not toxic to most of the grasses and is being used in fertilizers without adverse effect on soil micro-organisms.

Chlorinated hydrocarbons used as insecticides such as DDT and chlordane have been used in mixed fertilizers. Similarly, fungicidal mixtures have been reported to be in use in America and

include various mercury compounds, sulphur, fermate, Dithane, Arasan etc., Apart from these, there are also the multiple purpose mixtures supplying nutrients, herbicides and pesticides such as 7—5—5 grade containing 1% of 2, 4–D and 0.25% Lindane.

Method of application: Fertilizers should never be placed directly above or below the seed though separated by a soil layer. The American National Joint committee on fertilizer application has published (1938 quoted by Collings) its recommendations for some field and horticultural crops and this could be followed with advantage in the placement of fertilizers for different crops.

Fertilizers have a bright future and this is especially true in our country as we are just entering the fertilizer age. Large-scale production of fertilizers have only just been started and much remains to be done in this important field in our country.

Cytogenetics

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In Cytogenetics and Plant breeding, the conventional methods of collection, introduction, selection and hybridisation have been in use in this department since its inception. These methods are the most certain and are the basic ones for obtaining the desired plant selections. In the investigation of the fundamentals of genetics, much ground has been covered in the several crop plants, some systematic and others as and when the occasion arose. The storehouse of all desired characters has been in the wild plants from which the cultivated ones have been later selected. We have often to go back to nature to incorporate certain required characters into the cultivated type and also to invigorate it, make it resistant towards pests, diseases and adverse conditions. The scientist also watches for suitable mutations to occur in the homozygous materials. These occur at very low rates. Attempts have been made to increase the rate of incidence of such mutations by the application of agencies which cause changes in the heritable material. The conception of the gene or the heritable unit is still nebulous, though something is known about their location, arrangement and constitution. The gene cannot be newly created but an existing gene can be made to change by readjustment of its molecular structure. In taking recourse to hybridisation whether it be intervarietal, interspecific or intergeneric, only gene recombinations are produced.

In the following are stressed some of the lines of investigations which deserve a systematic trial so that the crop plants in general may be thoroughly understood and useful recombinations could be obtained with greater certainty. Experiments in the production of autopolyploids have been done in most crop plants in a satisfactorily systematic manner and a fairly wide ground has been covered.

In recent years considerable work has been done not only to produce artificially mutations but also to accelerate their production by the use of external agencies like x-rays, radium emanations, heat and chemical reagents. Interest in this kind of work was greatly stimulated by the discovery of Muller in 1928 that x-rays induced mutations in *Drosophila* similar to those occurring in nature but with a considerably greater frequency. Stadler (1928) working on the genetic effects of x-rays on barley and wheat, demonstrated the possibility of experimental

modification of heredity in plants by subjecting them to penetrating radiations. Since then several plant species, *Datura*, tobacco, cotton, maize, rice, millets, onion, tomato, flax etc. have been subjected to the action of several external agencies for production of variations and a considerable body of data has been accumulated. Although most of these induced mutations are recessive, and at first abnormalities and uneconomic ones are noted, numerous economic mutations appear in later generations. Horlacher and Killough (1931) studying the genetic effects of x-rays on cotton have put forth strong evidence for the occurrence of dominant progressive mutations also as a result of irradiation. With the improvements in technic systematic work with x-rays has shown that a good number of useful variations could be produced. Gustaffson (1947) discusses at length mutations in agricultural plants. Intensive and systematic work is being carried on in Sweden, England and America. Work on barley in Sweden has produced mutations for earliness, lateness, winterhardiness, straw characters, malting qualities and higher yield. In rape and mustard, strains with higher yield and oil content have been induced. The rate of mutations is some plants has been estimated at 300 times over the control. The usefulness of the x-rays in vegetatively multiplied plants is practically unlimited. There is yet another source of obtaining variations which has not been sufficiently exploited and that is vegetative buds. Vegetative variations known as "bud sports" have no doubt arisen from time to time in plants, but attempts have not so far been made, as a regular method of plant improvement to produce them artificially and increase the material for selection. The application of this method in encouraging the growth of dormant buds which may carry latent variations and which in normal agricultural practice are not given an opportunity to develop into shoots, and by causing injury aud mutilations to them by cutting and grafting to sexually propagated plants have not been intensively investigated and that is presumably due to the lack of necessity for vegetative propagation in such plants which readily set seed.

Recently the United States Department of Agriculture has set up a programme of research with the co-operation of the Atomic Energy Commission, in which the influence of radioactive materials on the growth of crops is to be studied. The programme includes researches (i) to measure the effects of additions of radioactive materials to soil fertiliser on the growth, maturity, yield and composition of various representative crops, (2) to determine the influence of low activities of alpha, beta and gamma radiations on the germination of seed and the growth and vigour of seedlings, and (3) to ascertain the influence of the radioactive materials on the number and activity of the bacterial and other soil micro-organisms. Usually plant hybridisation work is laborious and time-consuming. Several methods have been adopted for artificial emasculation of hermaphrodite flowers such as hot-water treatment etc.

poisonous, they have the merit of destroying a variety of insects at one stroke, and at the same time stimulating the plants to better growth and higher yields. The recovery of the affected plant is a new feature. Some borer pests, hitherto a serious problem, for example, the paddy stem borer and cotton boll worm, seem to yield to treatment with these insecticides. The problem on the choice of insecticide and preparation of a spray schedule for each important crop, would be the next line of approach in insecticidal method of control. Insecticidal method of pest control has come to stay and for years to come a major part of our researches is bound to be directed towards perfecting this. Newer and better chemical formulations are being discovered from time to time and even against external feeders, for which we have already evolved suitable remedies, better and more effective remedies are to be found. To speed up pest control work within a limited time over large areas, the possibilities of dusting or spraying by aeroplanes through State agency or by private firms and organisations at nominal cost to ryots, have also to be explored. The first of its kind has been reported in connection with control of *Pyrilla* of sugarcane in Bhopal.

(3) **To what extent insecticidal method is really useful:** We are going ahead with insecticides. The cultivator begins to think of nothing else than insecticides in tackling his insect problems. The intrinsic merit of this method is quick action and destruction of insects before our very eyes. But on the whole, the effect is temporary. On principle any insecticide which will leave a poisonous material as residue, however useful it may be for destroying insects, is not admissible, especially on food crops. This is a matter for serious consideration. On one side, we would like to have insecticidal action after one treatment to persist for long, with a view to check every new wave of insect attack, and at the same time we want no poisonous residue to remain for long on the treated crop to avoid danger to human beings and livestock. The real fact is that control by pesticides is only of temporary effect. It requires repetition, to save a crop completely from seedling to harvest. The operation does not eliminate causes for recurrence of the pest or pests in one and the same crop, during the same season. Hence at every season of crop growing, the same pests may appear regularly, in spite of tons of chemicals used in one season. In the light of these considerations, the insecticidal method of control has to be considered only as a measure of immediate practical value and for lasting and collective benefit reliance has to be placed on methods other than insecticidal.

(4) **To know where and why insecticidal method fails:** Insecticides act on pests by contact, inhalation or by ingestion. Some insecticides such as BHC, Folidol, etc. may combine one or more or all these qualities when once the insecticide reaches the insect. Insects living in concealed situations in roots, stems, buds, fruits, etc., for example the cotton stem weevil, borers affecting paddy, cholam, mango, orange, coffee, etc.,

caterpillars boring into buds, flowers of jasmine, brinjal or borers like mango stone weevil, fruit borer in brinjal, fruit flies in gourds, melons, plums, mangoes, etc., are all affected only slightly by application of insecticides outside. Similarly, mealy bugs and hairy caterpillars have protective coverings. These require special investigation for evolving satisfactory methods of control. In the case of all borers the adults lay eggs from outside. In the case of mealy bugs, the protective covering is least during a short period of the early young stage. In the case of hairy caterpillars, like *Amsacta*, newly-hatched young ones have less of hairs. The insecticides applied, should therefore be timed to the occurrence of these critical stages, failing which the efforts will be fruitless.

(5) **What exactly are other methods to be brought in:** (a) The problem of pest and pest control has to be viewed in a more comprehensive manner as a State problem. While insecticidal method of control has established and will continue to have a permanent and important role in the solution of all future pest control problems, other practicable methods also have to be explored. Investigations of a long-range and more costly nature likely to result in permanent good have to be undertaken. Control by biological methods, is one of this kind. It is practised widely in many countries. It is not new to India. Our State has done some pioneer work in the line. Use of the imported beetle *Rodolia cardinalis*, its multiplication and liberation and its subsequent establishment in the Nilgiris and effective control of the fluted scale, is a notable example. The control of the black-headed caterpillar of coconut by parasites is another notable achievement in this line. Indications of promise have already been obtained in the use of the egg parasite *Trichogramma* to control sugarcane borers and cotton bollworm. *Cryptolaemus montrouzieri* is noted as an effective natural enemy of Brinjal mealy-bug. There is unlimited scope for work in this direction, in view of the large array of parasites and predators recorded in our region. While insecticidal methods are no doubt effective and unavoidable to meet individual cases of pest outbreaks, it is no solution for the problem as a whole. Pests occur again and again and any natural force built up to check undue multiplication of particular pests would go a long way, especially with reference to those that are chronic pests in the State. The benefit is not merely to individual cultivators but to the region as a whole. The work, if established once, results in inestimable good for years. It is not within the scope of individual cultivators to undertake such a job. It is purely a State aid. Expansion of work in the direction of application of biological methods in pest control is necessary, whenever possible. Secondly, in any systematised pest control campaign, a knowledge of the relationship between weather factors and incidence of pests is a definite advantage. Our attempts at forecasts of pest outbreaks, can be made more precise. Insecticidal measures can be taken up at the very start of infestation. Prophylactic treatment can be reduced to the periods of likely occurrence of pests. Biological control, can be intensified at times favourable for the parasites to multiply in nature. This again is a long - range study.

Lastly, the answer to "What next" will not be complete without mentioning one or two points relating to fundamental systematic studies, Education and Extension. Systematic Entomology forms the basis of all economic work on insects and for all-round progress in entomological research in the State, it is very necessary that we develop this aspect and evolve specialists in this line of work also. In the field of Education, the subject of Agricultural Entomology is even now considered as a minor subject and what was squeezed into a two-year period, remains the same. It is high time that this subject is given its right place, in view of the increasing importance that is now given for Plant Protection work. The student taking the degree, should be equipped with fuller information. Changing the syllabus alone without adding more hours is ineffective. The subject should have the work distributed to the full three-year period of the course. In the field of Extension, for some years to come, there should be more practical demonstrations under direct departmental supervision, especially when dealing with highly poisonous substances as insecticides. It may even be necessary that in special cases, results of research done in State lands should be put to further observation in cultivator's fields to carry conviction. There is unlimited scope for expansion of plant protection work in the State.

Conclusion: We are aware of the pests that infest various crops. For control of pests the use of pesticides is the rule of the day. It is gaining momentum. Science is tending towards the use of very poisonous substances for pest control. We should proceed with caution. In the meantime, information should be built up as to how to use the various insecticides with safety to the crop, safety to man and livestock and at the same time destroying pests. Insecticidal method of control does not confer long-range benefits, and it is likely to prove uneconomical with falling prices of produce and the low margin of profit. It should be the State's endeavour to adopt the more peaceful method of biological control of aiming at common and lasting good to all, without much cost to the cultivators. Wherever possible, Education and Extension should aim at maximum equipment and intelligent appication of findings of research by convincing demonstrations in cultivator's fields in a more extensive scale.

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Prospects in Plant Pathology

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Plant diseases are worst of the natural hazards in farming that make agriculture a gamble. Numerous diseases attack our economic plants and the losses caused are so heavy in certain seasons that famines occur, bringing in untold sufferings to people. Even in advanced countries like the United States of America, where great progress has been achieved in the control of plant diseases, the loss sustained due to diseases is estimated at three billion dollars every year and it needs no mention that in India, where only a fraction of the farmers take to disease control, the loss sustained would be very much greater. The tragic aspect is that much of this loss is a preventible waste. Waste is unworthy of a great nation and is contrary to the laws of nature. However, disease control is not easy in all cases. New diseases and new races of old disease-producing organisms appear all the time. Man's interference with the balance of nature, by domestication of plants, intensive cultivation etc. has brought in an increase in the number and intensity of diseases. Hence much remains to be done and continuous intensive research is needed to minimise the losses due to plant diseases.

The losses caused by plant diseases are sometimes enormous and the cultivation of certain crops in some countries has had to be abandoned in the past, owing to the ravages of disease e. g. coffee cultivation was abandoned in Ceylon due to the severity of the rust disease.

Notable progress has been already made in the investigation and control of a number of plant diseases. Still, there are several diseases which are either very difficult to control or for which there are no effective control measures. A number of diseases like root rots and wilts caused by soil-borne fungi, as well as a number of bacterial, virus and deficiency diseases require further investigation. Even in the case of diseases for which effective control measures exist already the possibility for further improvements by the use of more efficient fungicides and by reduction in the cost of control measures have to be explored.

Among the various methods of disease control, use of resistant varieties is the cheapest metod, as it entails no additional expenditure to the cultivator towards control measures. Evolution of resistant varieties by combining disease resistance with other desirable agronomic characters is not possible in all cases and it needs continuous research

It would help in producing a large number of hybrids if methods are available in which the anthers are rendered sterile without the stigma being affected. Chemicals like 2, 4-dichlorophenoxy acetic acid Maleic hydrazide, = Tri-iodo-benzoic acids and Naphthalene aceti acide have been reported to produce such male sterility (Rhen 1952). An interesting applications of genetic knowledge to plant breeding is the utilisation of male sterility in the production of hybrid seeds. Cytoplasmic male sterility was utilised for hybrid seed production in onion, maize etc. A preliminary experiment with 2, 4-D done in tenai, gave indications of positive results.

Somatic reduction has been recorded in a number of plants (Coffee, Cotton, *Oryza* etc.) and also been artificially induced. Huskin (1948 and 1949) has reviewed the literature on this subject. Sodium ribose-nucleate, and sodium nucleate were found by him to induce somatic meiosis in root tips of *Allium cepa* and other plants. This method of reducing the chromosome numbers from the diploid to the haploid level, as also that of higher polyploids to the diploid level has rendered the analysis of chromosome complements, and genomic analysis easy. This would give the breeder a useful tool to obtain completely homozygous plants. In many crop plants investigations on the relationship of the genomes between the cultivated races and the wild are being carried on in greater detail to know the degree of homology and the possible recombination effects, when hybridisations are made. A systematic study on this line of work is also called for.

The determination of linkage groups is of great importance in economic breeding as knowledge is obtained with regard to the genes that are combined together, the recombination possibilities, and the particular genes that could be made use of as marker genes for a particular linkage group. None of the crop plants grown in this State has been completely and systematically worked on this aspect.

The search for ancestral forms and through them the basic genome has been a very important item in the breeding programme of all crop plants. In seeking new genes, special attention should be paid to the centres of origin of the ancient forms, for it is in these centres that plants with great genetical diversity may be found. The transformation that has been effected in potato, maize, wheat, rye, cotton etc. as a result of the incorporation of wild genes collected through extensive expeditions is now a matter of history. The immense value of expeditions to these centres and collection of wild relatives of cultivated plants is emphasized. The study of the genetics of the wild plants related to the cultivated ones is also stressed.

In the field of plant improvement, cytogenetical work has to be intensified and more economic plants have to be brought within its

scope. More fundamental work untramelled by considerations of immediate application will also have to be undertaken. This will help in the formulation of general principles and new and improved techniques which are vital to the progress of applied research. As science is primarily a mental discipline which is so variable with individuals, it is worthwhile to have a number of men working at the same problems and aspects to secure successful results. It is only by team work that substantial progress can be made.

Summary: The following investigations are suggested for inclusion in the future programme of cytogenetical research in this State: Systematic studies of (1) irradiation effects on crop and fruit plants with a view to production of new mutations, (2) Action of chemicals in the production of mutations as also male sterility for use in hybridisation and production of hybrid seeds, (3) Study of the relationships of the wild with the cultivated species and production of homozygous plants through induced haploids, (4) Systematic study of linkage groups and chromosome mapping as a help in the production of desired recombinations with greater certainty and (5) Collection and study of the wild plants with regard to their behaviour, genetics etc. and the selection of suitable races to be hybridised with the cultivated ones for crop improvement.

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Agricultural Entomology

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As a result of intensive work during the past half-a-century, we have a large number of published records regarding the insect fauna, pest occurrences and their life-history studies, etc., in relation to all important crops grown in our State. The two publications of Ayyar T. V. R., "Annotated list of insects affecting the important cultivated crops of South India (1932) and "Handbook of Economic Entomology for South India" (1940) give considerable information on entomological problems of South India. These are of inestimable value to guide future work. More recent achievements are in the field of insecticidal method of control. These and related progress, are to some extent brought out in the Departmental Memoirs of 1950. Appreciable work had also been done in the biological method of insect control and the pioneer work on the control of the cottony cushion scale in the Nilgiris and the Black-headed caterpillar of coconut carried out by Y. R. Rao and others (1944 and 1950) stands to the credit of the Madras State. "Bee-Keeping in South India" is another departmental publication, which is serving a very useful purpose by embodying valuable information on apiculture, relating to bees.

Insecticidal methods of control gained prominence after World War II. This feature accounts for giving a new and permanent place for Entomology in Extension Service.

Emphasis on insecticidal methods of control, have, however, brought in new problems. We have a strong and powerful weapon in our hands, and our immediate problem is to study (i) to what extent we can use, (ii) how best it can be applied, (iii) to what extent it is really useful, (iv) to know where and why it fails and (v) what exactly the other methods are that have to be brought in.

(1) **To what extent we can use insecticides:** Pesticides in use are mounting in quantity, thanks to convincing results and the increasingly effective propaganda exercised by the extension staff. A change in the mind of the cultivator is evident. He no longer keeps quiet when any pest is threatening destruction of his crops. One of the most important aspects of this change has been the recognition that crops can be made more productive by control of pests at proper times by proper methods, but if neglected due to ignorance or indifference, will result in considerable loss. In many places, primitive methods of farming still prevail. Lands should be made more productive by adopting modern scientific methods. Small holdings should get maximum income. One of

the methods is to reduce loss of yields from pests. There is much scope for increased use of pesticides.

In this connection, many insecticides have been departmentally tested as to their efficacy, the dosages at which they can be applied, the insects against which they are successful, the plants or crops which can be treated safely and the method of application without hazard to the operators. The synthetic chemicals and systemic insecticides are useful against a variety of pests and are safe to apply on almost all plants, with few exceptions. Sulphur has specific action against mites. DDT works well for controlling jassids, caterpillars, and beetles BHC is useful to control a variety of pests and shows quicker action, but imparts a taint or off-flavour in the case of root crops, when applied to soil. Both DDT and BHC may injure foliage, especially of cucurbitaceous plants. The research on this line has to continue not only to study the beneficial and adverse effects independent of insecticidal action, but also to find out ways and means of assessing residues on treated material. There are limitations imposed by operational difficulties and risks that arise on the use of highly poisonous chemicals such as organophosphates, which injure man by contact, inhalation and by ingestion. The use of these requires careful planning, technical skill and experience and careful supervision. The use of these insecticides is therefore to be taken up with due caution and popularised only by slow degrees however effective they are. Problems of residues, of handling of substances deadly to man, and problems of deciding the economic use of the insecticides, are fields where more work and more information are urgently necessary.

(2) **How best insecticides can be applied:** During a severe outbreak, where the crop in extensive areas is brimming with insects of the same species, really spectacular effect is seen, by the action of insecticides applied on a large scale. But invariably it so happens that the insects have already caused havoc to the crop, even when we take immediate measures to treat the crops. In killing insects, we have incurred some expenditure too. One often feels that the presence of insects should have been noted earlier, to avert damage and minimise loss. Thus timely application is one of the most important aspects of the problem. Secondly, often we meet with more than one insect, in one and the same crop either at the same time or at different growth-phases of the crop. In many of our crops, the margin of profit is so low that it does not admit of expenditure for repeated treatments. Investigations now in progress towards determining critical stages, when the minimum number of treatments will assure maximum efficiency, are highly important. A further step would be to choose insecticides of multipurpose value and apply the same as prophylactic treatments. Hopeful indications in this line are not wanting. The pesticides Folidol and Endrin are new-comers satisfying these requirements. Though both are highly

to meet the everchanging situations due to frequent occurrence of new races of pathogens. Though success cannot be assured in all cases, yet this is a very fruitful line of work and has to be pursued to the maximum extent possible, especially in the case of diseases like paddy blast, wheat rust, red-rot of sugarcane etc., which are not easily controllable by chemical methods. Other methods of disease control, such as use of disease-free seed materials, seed treatment, soil sterilization, protective spraying of the crop with fungicides also play an important role in controlling plant diseases and further research is required for testing of new chemicals. Preventive spraying or dusting of fungicides form the most important item of plant protection work. It is interesting to note that a number of new and more efficient fungicides are put on the market in recent years and constant testing of the new chemicals is very essential, to make spraying more efficient and cheaper. Universal application of fungicides to crops whether there is disease or not seems to be in vogue in certain countries but it is a laborious and costly operation. Our experience shows that epiphytotics or epidemics do not occur every year in every place appear but only in certain years where conditions are favourable for its development. If these conditions could be studied and the incidence of disease forecasted in time much of unnecessary spraying operations can be avoided. So research has to be carried out for minimising the area to be sprayed. This can be done only by developing a very efficient and reliable method of forecasting disease incidence, so that spraying can be carried out only. tin such localities where the spread of the disease is most likely to occur. Of course the present weekly forecast system in operation in our State is a pioneer work in this direction, but attempts should be made to make it as accurate as possible, as this will ensure savings in the spraying bill, which may otherwise go up to Rs. 40 to 50 per acre for three or four rounds of spraying. Again, disease incidence is governed by three important factors viz. the host, the parasite and the environmental factors. For a correct forecast of disease incidence, all these factors require to be studied in detail, in collaboration with the meteorologist. The possibilities for further research in the selection and use of fungicides, improvement in the spraying and other equipments are indicated in the following paragraphs.

Use of Chemotherapeutants for the control of plant diseases: Much of the work on chemotherapy (that is by introducing curative chemicals into the plant) has been done on systemic diseases. Promising results are reported to have been obtained in the case of Dutch Elm disease, Fusarium wilt of carnations and tomatoes. Inorganic salts, sulphonamide derivatives, hydroquinones, benzoic acids, phenols, 8-quinolinol benzoates, azoderivaties and antibiotics have been used. Of the antibiotics used as systemic fungicides mention may be made of griseo-fulvin which is produced in cultures by *Penicillium nigricans.* Recently it is reported

that *Rhizoctonia* on gilly flower plants could be controlled by soil application of 8-quinolinol sulphate. There are a number of diseases caused by *Rhizoctonia* fungus and further investigations on the above lines may yield fruitful results.

Use of antibiotics for control of plant diseases: Antibiotics is an old phenomenon to the plant pathologist. The first of our modern antibiotics, gliotoxin was discovered and crystalized by a plant pathologist even before penicillin had been purified and the role of gliotoxin in plant protection was investigated as early as 1933.

The most common method of application of antibiotics is to use them as spray solutions. Streptomycin is reported to give perfect control of fire blight on both apples and pears, bacterial spot of tomato, common blight of beans, and wild fire of tobacco. Another antibiotic viz. terramycin, which has also been extensively tested, gives control of bacterial diseases. The antifungal agent actidione is very effective against powdery mildews of various crops, though its toxicity to the host plant should be taken into consideration. Another promising use of antibiotics is in seed treatment. Even deep-seated infections of seeds by fungi are reported to be eradicated by actidione and helixin B. Budwood of plum trees is reported to have been freed of *Phytomonas pruni* by soaking infected twigs in solutions of streptromycin G. The antibiotic has been injected in trees by various techniques and shown to have a protective effect against certain pathogens. The ideal type of treatment would be a soil drench. The plant could then absorb the antibiotic from the substrate and transport it to the place of infection and this aspect requires further research. Antibiotics are often quite specific in their action; some will inhibit only a few species of microorgansms, while others will inhibit a vide variety. Expansion in the application of antibiotics to agriculture is possible only after extensive experimentation with various crops under local conditions. Several new organisms can be isolated from soil and tested for their ability to produce antibiotics which will control plant diseases.

Virus diseases: The importance of serology in virus research and the utility of the electron microscope in plant virus research have already been realized. Just as the optical microscope made a major contribution to bacteriology, the electron microscope has extended our limits of observations and the virologist can now observe the infectious virus particles. In course of time the electron microscope would make a contribution to virology comparable to that of the microscope to bacteriology. Observing viruses in their host cells has now become possible through the development of techniques for cutting ultra-thin sections. Virologists have already applied the thin-sectioning technique to a study of virus development in tissue cultures in the case of animal viruses.

This may be a fruitful field of investigation for plant viruses also. Since it has not been possible to see any internal detail in plant viruses, successful attempts have been made at breaking the virus into smaller fragments and this could be called a dissection, (undoubtedly the smallest on record) and examining them. Quantitative electron microscopy for the determination of the number of virus particles in a preparation merits a wider application. The picture already obtained by the present freeze-drying method are much superior to those obtained by the ordinary air-dry techniques and more study of the freeze-drying method is needed. A number of virus diseases affecting such crops as potato, tomato, tobacco, sugarcane, sandalwood etc., occurring in our State require detailed investigation.

Toxins and plant diseases: The micro-organisms causing diseases produce toxins (microbial poisons) that penetrate into host tissues. Although considerable study has been made of the toxins produced by pathogenic bacteria in medicine, its implication in plant pathology are only beginning to be appreciated. Knowledge of these toxins opens up new possibilities of eventually combating plant diseases, not by attacking the parasite itself but by inactivating its toxins by means of substances which would render them harmless, as is done in the medical treatment of diphtheria.

Low-volume spraying: The adoption of low-volume spraying technique whenever possible will have many advantages over high volume spraying. A large proportion of the cereal weed spraying with hormone weed-killers is now reported to be carried out using low volume spraying equipment. By applying a fungicide with a low volume sprayer, large areas can be treated very quickly with small demands upon labour and with only 10% of the water required for high volume spraying and with quite large savings in the actual amount of active chemical required per acre. However there are certain limitations, one of which is the factor of evaporation in warmer climates. In order to obtain an even coverage the size of the droplets must of necessity be small. Such small droplets of a water-based spray tend to evaporate very rapidly under tropical or semitropical conditions and this has restricted the adoption of low-volume technique. The results obtained elsewhere during the past two seasons have brought out the efficacy of oil-based fungicides in overcoming the evaporation factors. The following spray formulation 4 gallons of white oil, 4 gallons of diesel oil and 17½ lb of copper oxychloride containing 50% copper was reported to give excellent control of banana leaf-spot, using only five gallons of the mixture per acre. There was no scorching effect due to diesel oil. On the other hand the oil seems to play some synergistic role in the spray fluid. It is suspected that the oil itself has some fungicidal value. The use of oil-based sprays is only in its infancy and there is

need for further investigations before their true value can be assessed, though there seems to be a good future for oil-based sprays.

Of late a number of fungicides on the market are claimed to be specific against certain kinds of diseases. These require careful screening and testing so that only the best of the lot may be recommended for large-scale use.

Finally it may be said that knowledge is never complete and there remain many mysteries of Nature yet to be understood. In this connection it may be mentioned that the great American essayist Emerson has written:

"He in whom the love of truth predominates ...... will abstain from dogmatism. ...... He submits to the inconveniences of suspense and of imperfect opinion but he is a candidate for truth ...... and respects the highest law of his being". The real man of science, the seeker after truth is conscious of the paucity of his real knowledge, but has confidence in his ability to know and to understand.

The Need for Research on Soil Actinomycetes in India

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Introduction: Though actinomycets are of universal occurrence in nature, their existence was noticed only two centuries after Antoni van Leeuwenhoek, who is considered to be the Father of Microbiology, first observed bacteria in his 'microscope'. The first report on an actinomycete was made by Ferdinand Cohn in the year 1875 and since then several reports have appeared on their occurrence in soil, composts and manure heaps and also as plant, animal and human pathogens and detailed investgations have been carried out. As a result it occupies at present a very prominent position in industrial and agricultural microbiology. Studies on actinomycetes started in the United States when Dr. Selmen A. Waksman, at present Director of the Institute of Microbiology, Rutgers University, entered this field. In the spring of 1914, Waksman, while studing different groups of microorganisms in the soils of New Jersey Agricultural Experimental Station, came across the interesting but little-known group of 'ray fungi'. The reason for this neglect was brought out in his first paper on the subject in the following words: "The actinomycetes grow very slowly; they begin to develop from the bottom of the plate, and to the casual observer the colonies formed look like those of bacteria, even after 5–6 days' incubation; only the somewhat mealy or rough surface will disclose the fact that they are not bacteria. It requires careful observation to tell whether those white, pink or grey colonies are bacteria or not. Many counts of bacteria might have been confused, when this point was not known, and the fungi and actinomycetes were not taken into consideration". Intensive studies on the occurrence of actinomycetes in soil, their classification, physiological properties and their economic importance followed and his contributions to our present knowledge of actinomycetes as a taxonomically and industrially important group of microorganisms are invaluable. The knowledge available on the organisms at the time pencillin was rediscovered by Florey and his associates in England in 1941 was put to use by him for evaluating their use as antibiotic-producing agents and new techniques for isolation and study of these antibiotics were developed, as a result of which remedies for various deadly diseases have been found and thousands of lives

saved. In the place of a dozen or so laboratories working on actinomycetes throughout the world before 1940, nearly a thousand laboratories are doing intensive research on this group of organisms in the United States alone at present and perhaps another thousand or more laboratories are engaged in this work in other parts of the world.

It is to be regretted that this important group of organisms has so far been very much neglected in India. It is the intension of the author to bring out in this article the economic importance of actinomycetes and to make some suggestions for their study in India.

Actinomycetes as microorganisums: Actinomycetes form an important group of microorganisms intermediate between bacteria and fungi. Because of their filamentous nature earlier workers were inclined to include them under fungi, but the knowledge obtained now show that they are more closely related to bacteria than to fungi and the latest edition of Bergey's Manual of Determinative Bacteriology has included them under the class *Schizomycetes* and order *Actinomycetales* with three families, *Mycobacteriaceae*, *Actinomycetaceae* and *Streptomycetaceae*. The family *Mycobacteriaceae* includes acid-fast bacteria of which *Mycobacterium tuberculosis*, is the most important. The true filamentous actinomycetes are included under the other two families. *Actinomycetaceae* includes the aerobic and microaerophilic pathogens belonging to the genus *Actinomyces* and the aerobic, mostly soil-dwelling forms, to the genus *Nocardia*. The last family *Streptomycetaceae* is economically and industrially the most important and the members of this family are known to be present in large number in soil, in dust, in manures and composts, in fresh-water lakes and river beds and in food products. Some of them are known to cause important plant diseases and food spoilage. There are two genera under this family viz., *Streptomyces* and *Micromonospora* of which *Streptomyces* is by far the most important.

Saprophytic Forms: Actinomycetes are distributed in various types of soil and at different soil depths as well as in other natural substrates in saprophytic form and they play a very important role in the decomposition of plant and animal residues and the formation of humus under condions which are unfavourable for the decomposition of organic matter by bacteria and fungi in general. Further, the important part played by the thermophilic forms, which grow in compost heaps at 60–65°C and decompose organic matter at that temperature where most of the bacteria and fungi do not function, is of great significance. The nature of their interrelationships with other microorganisms under natural conditions in soil and their significance in soil fertility is however not clearly understood.

Pathogenic Forms: Actinomycets are known from very early days to cause human, animal and plant diseases. *A. bovis* was the first

pathogenic form isolated from cattle in 1877 and since then aerobic and anaerobic forms of *A. bovis* have been isolated from infections on various parts of the animal body. The disease caused by this organism is commonly known as 'actinomycosis'. *A. israeli*, *N. asteroides* and *N. madurae* are known to be associated with animal diseases, sometimes resulting in serious troubles, but so far no epidemics due to these pathogens have been reported.

Potato scab or the common scab of potatoes is the most important of the plant diseases caused by actinomycetes. The disease is known since 1890, even though the causal organism was not recognized as a streptomycete at that time. Potato scab is one of the serious diseases of this crop. It is widely distributed throughout the world and has been extensively studied. The pathogen attacks young tubers and causes lesions in the form of small, brown spots which increase in size, leaving a shallow depression with irregularly ruptured skin and thick, corky outgrowths. The organism persists in the soil in saprophytic form for a long period. Among the other pathogenic forms known, *S. ipomoea* causing sweet potato pox and some species of *Streptomyces* causing scab of sugar beet and mangolds are important.

Actinomycetes in Industry: Actinomycets were known for long to produce various pigments in synthetic and complex organic media, but little was known about the chemistry of these substances. With the recognition of their ability to produce antibiotic substances the physiology and biochemical activities of the organisms have been studied in detail. It is now established that actinomycetes are by far the best microbial agents for the production of antibiotics as compared to bacteria and fungi. More than 200 antibiotics have so far been isolated from them, of which nearly ten have found industrial use and several more appear to be promising. *S. griseus* is the first of the series of actinomycetes which went into commercial utility in 1945 and in 1953 more than 4,00,000 lb. of streptomycin, valued at $ 48 million (about Rs. 23 crores) was produced in the United States alone and during 1954–55 there has been a further increase in production, due to its use as animal feed-supplement and for plant disease control. The sale of other actinomycete antibiotics in the United States was estimated as $ 160 million (about Rs. 77 crores) in 1953 and during the past two years several industrial concerns throughout the world have started using actinomycetes for antibiotic production, involving large investments. The evidence accumulated so far indicate that the antibiotics very greatly in their chemical composition and antimicrobial property with an ever-expanding field of applicability, which in turn widens the scope for commercial expansion.

Besides producing antibiotics, actinomycetes are known to synthesise vitamins, especially vitamin B_{12}. *S. griseus*, the organism

producing streptomycin is also known to produce vitamin B_{12} when cobalt is added to the medium. Among the various enzymes produced by actinomycetes, protease, amylase, invertase, pectinase, and oxidase, particularly some of these produced by the thermophilic forms, are considered to be of great importance. Several species of *Streptomyces* and *Nocardia* have been studied for this purpose. Some of the faster growing species like *S. griseus* and *S. lavendulae* are known to produce lactic acid, succinic acid, acetic acid, ammonia etc. under specific conditions. The uneconomic quantity of these substances produced in the broth, however, prevents the industrial applicability of the organisms for the present.

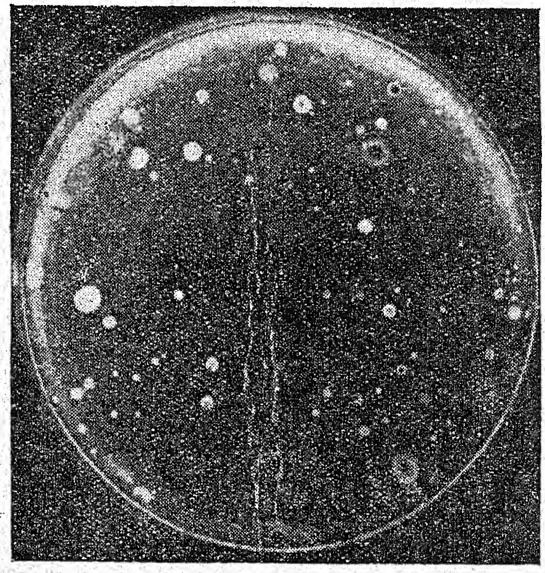

FIG. 1

Predominant development of actinomycete colonies in Ken Knight's agar medium plated with a soil sample at a dilution of 1 : 100,000.

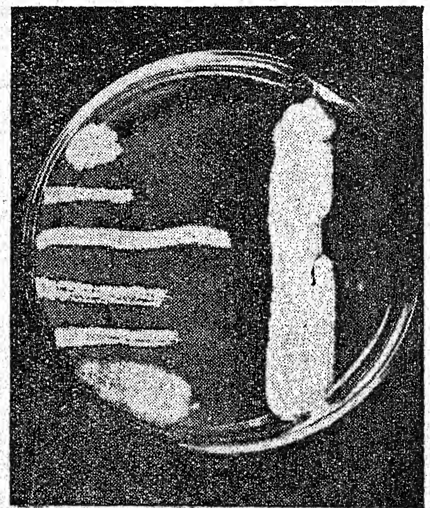

FIG. 2

Antagonistic property of a strain of *Streptomyces lavendulae* producing a new antibiotic, Mycothricin, recently isolated by the author. The organisms inhibited are: (1) *Bacillus subtilis* (2) *Escherichia coli*, (3) *Pseudomonas fluorescens*, (4) *Candida tropicalis*, (5) *Saccharomyces cereviseae* and (6) *Aspergillus niger*.

Actinomycetes in Agriculture: Large populations of actinomycetes are known to exist in soil and only a handful of species are reported to be plant pathogens, whereas others are, though indirectly, beneficial to the growth and development of plants. They play an important part in the decomposition of organic matter and humus formation. Another very significant function of actinomycetes is their antagonistic property which prevents the growth and spread of plant pathogenic organisms added to the soil. Though several actinomycetes have been known to be inhibitory to soil-borne plant pathogenic bacteria and fungi, they have not been advantageously utilized so far because of several difficulties involved. Recently antibioties of actinomycete origin have come into use in agriculture as animal-feed-supplements and plant disease sprays. Some streptomycin preparations (Agrimycin, Agristrep, Strep-Nitrate etc.) are being put to use on a commercial scale. The inhibitory power of some of the metabolites of actinomycetes against plant virus infection seems very promising and probably the only effective remedy for some of the unsolved problems in plant pathology like soil-borne fungal diseases and virus diseases is in actinomycetes and the antibiotics derived from them.

Past work in India: The work done so far on actinomycetes in India is very little and comparatively insignificant. The first report on an actinomycete in India seems to be that of Joshi (3) in the year 1915. While studying nitrifying organisms in soil, he isolated a 'new type' of organism differing morphologically from other known ones at that time and called it a 'nitrite-forming organism'. The photomicrographs and the descriptions of the organism given by him show that he was dealing with an actinomycete. An organised attempt to study soil actinomycetes was made by Norris, Subrahmanyan and Ganesha Rao (5) in the year 1929. These authors collected soil samples from different places in India (some of them now in Pakistan and Ceylon) and isolated actinomycetes, using a starch-agar medium with minimum amount of nitrogen. The total number of colonies obtained per gram of soil varied from zero to four million. According to them 1 to 15 types of colonies were observed in each sample and a majority of them were chromogenic. In their concluding remarks they said: "With our present knowledge it is not possible to define the exact role of actinomycetes in relation to soil fertility and plant nutrition. Much work still remains to be done on the physiology of the more prominent varieties commonly occurring in the soil, particularly under conditions similar to those obtained in the depths of forest areas and the interior of manure heaps, before their importance can be properly assessed."

Since then a good deal of work has been done in other parts of the world and various aspects of the role of actinomycetes in soil fertility and plant nutrition worked out, but not much has been done in India.

It is not known how far the results obtained in other countries are applicable to Indian soils. Some attempts, however, have been mada by a few microbiologists in recent years, to study the soil actinomycetes and some of the isolates have been reported to possess antibiotic properties (2). Studies made on the rhizosphere microflora of some of the important crop plants of South India have revealed that there is a greater accumnlation of actinomycete population in the rhizosphere of Sorghum than in other plants investigated (1). *S. scabies*, the organism responsible for potato scab has been reported to be a serious problem in some parts of India (4) but no detailed study on the disease has been made so far.

Suggested methods of approach: As has been already pointed out, the main reason for not paying enough attention to the study of actinomycetes in the difficulty involved in the isolation, identification and classification of the organisms, as they are slow-growing, require special media for growth and special technical knowledge on the part of the investigator for these studies. A large volume of literature on the subject has accumulated and some excellent books have been written in recent years, but because of the small number of persons working in micrebiology in India, knowledge on this subject is not much. Considering the importance of this group of organisms in the agricultural and industrial development of our country it is essential to start intensive research in this field immediately. It is not possible in this article to go into all the details of work to be done in India to overcome the deficit, but the following suggestions are made as a beginning:

1. A thorough survey of the actinomycete population in different types of soils and at various depths throughout India. The microflora of soil types like rice puddles, garden-land soils, tank and riverbeds etc. are bound to contain species of beneficial actinomycetes, as the climatic conditions in India are very conducive to their growth and development all round the year, in most parts of the country. It is also needless to say that this potential resource in soil is no less important than the mineral resources for which extensive surveys are being made at present.

2. Screening of actinomycetes for antibiotic production, vitamin production and for other industrial and agricultural utility.

3. Study of the part played by actinomycetes in the decomposition of organic matter, humus formation and soil fertility in general. Since actinomycetes play a great role in the decomposition of organic matter in compost heaps, special attention should be paid to study this aspect in different original methods of composting followed in India.

4. Study of the interrelationships of actinomycetes with other microorganisms in soil and to explore the possibilities of controlling the

injurious microorganisms by favouring the processes brought about by the beneficial actinomycetes.

5. Identification and classification of actinomycetes and of the soil types in particular.

These suggestions are in no way exhaustive, but are of immediate importance. With the increase in our knowledge on soil actinomycetes in India, further studies on some of the fundamental aspects like genetics and cytology, physiology and biochemical reactions of actinomycetes, actinophage and its relationship with actinomycetes etc. and some of the applied aspects like utilizing agricultural and industrial waste products for the production of antibiotics, vitamins etc. can be taken up. Since the study of actinomycetes forms a great part of microbiology, it is important that students of microbiology in Indian Universities should all be taught the subject in detail and trained for future work in this field.

Acknowledgement: I wish to express my gratitude to Dr. Selman A. Waksman, N. L., for going through the manuscript and offering very valuable suggestions.

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Some Suggestions for Intensifying Plant Protection Work

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Sattur

Seven years ago, when the Plant Protection Service was inaugurated in South India in 1949, there was a feeling of pessimism in the minds of the public with regard to its success. It was a time when the ryots were already fed up with methods of control like hand-picking, netting, pruning and the slow-acting pesticides like tobacco-decoction fish-oil soap etc. The introduction of quick-acting chemicals like, BHC, DDT, Zinc phosphide and the intensive propaganda and demonstration of pest control operations organised by the Plant Protection staff, dispelled this idea and the ryots are now convinced that Plant Protection service is quite indispensible for stepping up crop-production. Indeed, we have now reached a stage when our services are largely sought after and appreciated instead of our services being reluctantly accepted as before. The ryots have now become pesticide-minded and they are very particular in preventing the incidence of pests, rather than controlling them after their appearance.

The progress we have achieved in the field of plant protection can be easily gauged from the demand for pesticide everywhere. The annual sale of pesticides in departmental depots in 1948 which was only a few hundred pounds, has progressively increased to hundreds of tons. Now a situation has arisen when the departmental depots alone cannot handle the entire supply of pesticides to the public. The merchants were quick in cashing in the good work done by the department in the popularisation of pesticides. A large number of private dealers have entered the field and they are now almost competing with our department. Of course, it is a welcome feature and it should be encouraged, provided no malpractices are tolerated. Instances have been however reported where 10% BHC has been substituted for 50% BHC. and Zinc phosphide adulterated with charcoal powder and sold at a cheaper rate. If such a state of affairs is allowed to continue, the public will lose confidence in the efficacy of all pesticides. Such fraudulent practices should be put an end to and the pesticide trade so regulated as to provide maximum benefit to the ryots.

Formerly, we had only a few reputed manufacturers of pesticides and fungicides catering to our needs. But with the large-scale use of pesticides, new concerns have been started to meet the growing demand.

As usual, unhealthy competition has resulted in price cuts and consequently degeneration of quality and efficacy of the drugs may soon follow. If the pesticide industry is to serve the cause of agriculturists, it is imperative that the Government should have strict control over the manufacturers. Rigid standards and specifications should be fixed for each type of pesticide and packed according to prescribed standards. In order to regulate the pesticides trade, the following suggestions are given ;—

(1) All the manufacturers should be licensed and their products tested for active ingredients they are said to contain.

(2) As far as possible, pesticides should be packed in air-tight containers, which will remain unaffected during transit and storage. The name of pesticide, percentage of active ingredients, date of manufacture and directions for use should be noted on the containers. The manufacturers should also market small packings of 5–10 lb. to facilitate retail sale and prevent adulteration.

(3) The merchants who deal in pesticides should also be licensed. Periodical analysis of samples drawn from their stock should be done to prevent malpractices. The plant protection assistants should be invested with powers to draw samples and check malpractices.

(4) Dangerous pesticides like Folidol, Zinc phosphide, Agrosan, GN, etc., should be issued only on the authority of the plant protection assistants.

The present set-up and organisation of Plant Protection service is inadequate to meet the problem of pest outbreaks in a comprehensive scheme of intensive agrroulture. The complexity of the pest control problem is fast increasing, with the introduction of numerous potent and dangerous pesticides like Chlordane, Toxaphene, H. E. T. P., Parathion, Schraden, Folidol, Endrin, Aldrin, etc. These require careful handling, systematic trials and assessment of results, before they are recommended to the ryots at large. There may come a time when some of our present-day popular pesticides like, BHC, and DDT will become obsolete and ineffective. Already reports are being received about the tainting quality of BHC and cumulative effect of DDT. Furthermore, insects develop resistant strains of their species against these insecticides. They respond to every new scientific offensive of man with a strong defence. Thus our search for newer and more effective drugs, along with useful parasites and predators should proceed unceasingly, until we are free from the ravages of pests and diseases. All these call for an elaborate organisation of highly-trained personnel to combat effectively pest and disease outbreaks. The following suggestions are offered in this regard,—

The Plant Protection staff should be organised into a separate section, with a network of specially trained field staff for each district. There need not be separate assistants or officers for Entomology and Mycology. Instead of stationing two asistants at the district headquarters as at present, each revenue division of three taluks must have an assistant, who should be in charge of both pest and disease control work. There should be a responsible officer for each division of three districts to supervise the work of the assistants in the division against large-scale pest or disease outbreaks. These divisional plant protection officers should be guided and controlled by the Government Mycologist and Government Entomologist as far as the technical side is concerned. For quick transport of men and materials, there should be a mobile unit attached to each divisional officer. Each unit should be fully equipped with power dusters and sprayers, hand-operated dusters and sprayers, spare parts, adequate stock of pesticides and fungicides, field equipments, etc.

In view of the backwardness of our ryots, who cannot take initiative themselves and carry out our instructions, it is imperative that the department itself should take control measures in all pest-affected areas. Suitable amendments shonld be made in the Pest Acts to enforce this provision. The cost of control measures can be collected along with land tax on acre basis.

In fine, plant protection service has got before it a wide field of useful work and with due encouragement from the government and the public, it is bound to play its rightful role in safeguarding crops from the onslaught of pests and diseases. It is very encouraging to note that provision has been made in the Second Five Year Plan to open more plant protection centres in the near feature. This will certainly help a great deal in increasing not only the production of food crops, but also commercial crops that contribute to the prosperity of the nation.

What Next in Rice Breeding?

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Paddy Specialist

As indicated by the title, the paper deals with only one important aspect of the subject chosen for the Symposium, "What next in Agricultural Research and Extension?" Before taking the next step and trying to keep track of the possibilities ahead, one has to look back and see what ground had been covered already, and what aims have been attained.

Work so far: Rice Research in Madras State was initiated in 1913, i. e. a little over four decades ago. Starting with genetical studies on the different characters of the rice plant, the work in early years drew within its orbit numerous investigations relating to the nature of the rice plant with reference to its growth and yield. As genetic knowledge progressed, a vast collection of genetic stock, so essential in breeding, also accumulated.

Improvement of the yielding capacity of the existing major varieties by 'Pure line selection' was the main object of the initial breeding programmes, which was later extended to the synthesis of economic characters by hybridisation.

Ninety-nine strains resulting from 'Pure line selection' and nine strains evolved by hybridisation are now under distribution from the Paddy Breeding Station, Coimbatore and six other Agricultural Research Stations. Notable examples of successful hybridisation are the 'blast' resistant strains, Co. 25, Co. 26 and ADT. 25.

These 108 strains, capable of yielding 10 to 15 percent increases on a modest estimate, have now covered 40 percent or two and a half million acres out of the total area of 6¼ million acres under rice in the State. Production now stands at three million tons of rice. Out of our population of 35 million, 70 percent or 24½ million are classed as rice-eating and the present production is found to be just sufficient to maintain them at a ration of 12 ounces of rice per day.

Taking all possible vicissitudes into consideration, double the quantity has to be aimed at which would mean that our production has to be stepped up by another three million tons. If the improved strains spread throughout the remaining 60 percent of the area also and if we

put the extra production at 100 lb. rice per acre, we may just produce an additional 1,75,000 tons.

This itself is probably the bright side of the picture. It is to be remembered that it is practically impossible at this stage of rice breeding to cover the extra area with strains. We have to reckon with a sizeable proportion of our lands subjected to drought and inundations as also saline and alkaline regions, for to which special strains are needed. Even in the matter of 'blast' resistance, we have only long duration strains at present. Short and medium duration strains resistant to 'blast' are yet to be evolved. We have also to eliminate loss from lodging, from premature sprouting of the seeds in short-duration varieties, due to their non-dormant nature.

We may now consider these various aspects separately.

Resistance to drought: It is estimated that an area of 3,70,000 acres is affected by drought every year to varying extents. The damage is caused in the early stages of crop growth in Malabar and South Kanara. Elsewhere it occurs in all stages. The average yield now obtained may be put at 500 lb. per acre but in certain seasons next to nothing is obtained by way of yield. The problem of evolving drought-resistant strains is not without hope, considering that there are already varieties showing moderate resistance. Besides, progenies are also available which are extracted from crosses between wild and cultivated types and between different dry types themselves. Rigorous testing of these materials remains to be done. It may be mentioned here that except probably what is claimed by Russian workers, no standard scientific method has as yet been evolved as an aid in breeding for drought resistance. Continued trials under natural onditions would appear to be the only feasible procedure at present.

Resistance to lodging: There are several areas in our State where lodging of rice crop in the pre-harvest stages, affects both the yield and quality of the produce. About six lakh acres of the first crop area in Malabar and South Kanara and about nine lakh acres in the other districts run the risk of being affected by lodging of the crop. It is estimated that a loss of 20 per cent is sustained by lodging and this over an area of 15 lakh acres as indicated above, is by no means negligible.

Some preliminary work in understanding the problem of lodging has already been done. The straw character of the existing varieties is found to vary considerably, resulting in different types of lodging. Non-lodging varieties have thick, persistent leaf-sheaths while lodging itself is to a great extent influenced by cultural practices. Genetically, the character appears to be governed by single factor difference.

The need is therefore felt for more elaborate studies relating to morphological and anatomical features of selected varieties, cultural features affecting lodging, as well as a thorough study of the root system. The problem is as important as it is many-sided; it is one that has a State-wide significance.

With the evolution of non-lodging strains, the problem of crop submergence can also be solved to a very great extent, barring of course, the typical deep water areas for which a character like 'stiff straw' has to be combined with certain other features as well.

There is still another important feature that has a close bearing to this problem of lodging. It is the dormancy of seeds. The grains of most of our short duration strains lack this charactor, with the result that if the ripening crop is caught in continued wet weather, the grains sprout on the plant itself. The damage caused is sometimes considerable. In fact, but for this drawback, most of our cultivators would be growing short-duration strains wherever conditions permit. Induction of dormancy in short and medium duration strains remains to be done on an extensive scale. Many of the existing varieties from cross progenies have also to be watched for this character. TKM. 6, a hybrid strain of short duration evolved from Tirurkuppam is a recent find which has this quality of dormancy to a remarkable degree.

Resistance to salinity: Saline and alkaline areas present problems peculiar to them. The cumbersome method of 'Kaipad' cultivation (Malabar district) in which the entire field is dug and patterned into regular mounds of sods to get the deposited salt washed down by monsoon rains, is perhaps the most ingenious cultural artifice that could be thought of. Nevertheless, a suitable strain would change the picture both in economy and in production.

In the case of other areas such a cultural practice is not feasible as the monsoon rains are scanty. There are, of course, the varieties SR 26 B and *Tellathokavadlu* which show a certain amount of tolerance. They need further improvement.

The next step will lie in the direction of making an extensive survey to collect resistant types from all over the country. Here again, it may be difficult to simulate, in a laboratory, conditions existing in the respective localities. What is required is an intensive hybridisation scheme and actual field trial of the progenies for a number of years.

Resistance to disease: Mention has already been made about the 'blast' resistant strains, Co. 25, Co. 26 and Adt. 25. These strains belong to the long duration group. Isolation of such resistant strains

of short and medium duration is the logical sequel to what has been recorded already. With this object, a scheme is now being worked and within the next five years suitable strains must be forthcoming.

A point to be noted in breeding for disease resistance is that more virulent 'strains' of the pathogen are found to develop as years go by. This makes the breeder's task all the more difficult. The only way out is to make the breeding itself a continuous process.

Conclusion: Broad indications of the work that lies ahead have been given without detailing theoretical concepts or technical procedure. Each aspect may well form a lifetime study by itself and unfold a number of ancillary problems in its course. Given the will and the facilities, success must come stage by stage and every stage will be a further landmark in the progress of rice-breeding in our State.

What Next in Millets and Pulses Research

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Introduction : Millets are grown mostly as unirrigated crops in areas of poor fertility. Being highly drought - resistant, they are the only staple food crops that could be grown in areas unsuited for the cultivation of paddy. Thus millets are complementary and not competitive to rice. Millets also provide fodder for cattle. It is estimated that they give nearly 6.5 million tons of straw to support 60 per cent of our cattle population. Cholam fodder, especially from the sweet juicy-stemmed varieties, is a prized fodder for the milch cattle of our State.

There are eight millet crops, of which Cholam, Cumbu and Ragi are known as the major millets and occupy nearly 75 per cent of the area while Tenai, Varagu, Samai, Kudiraivali and Panivaragu form the minor millets. These are cultivated over an area of nearly 5 million acres in the Madras State and the estimated production is 1.7 million tons of grain as against 6 million acres and 3 million tons of paddy.

Pulses, which are subsidiary food crops, are of great importance as the major source of protein supply in our diet. They occupy 1.2 lakhs of acres with an estimated production of 0.1 lakh ton of grain. This production meets only 10 per cent of our requirements viewed from nutritional standards. Large quantities are imported from other Indian States but the net available quantity for consumption in the State is still low.

Review of Work Done : Before formulating a plan of future work it is essential to take stock of our achievements so far.

Extensive collections of Indian and foreign varieties were built up from 1923, and the variations studied in the Millet Station, Coimbatore. Inheritance of most of the external characters and linkage groups were studied, as also factors affecting yield.

The second phase of work was directed towards isolation of pure lines from the local varieties. During the early years, grain yield alone was the criterion for selection. Subsequently, the yield of straw and quality of grain were also included as standards for selection work. Easy threshing ability in the strains was also another factor that entered into the picture. Since millets are grown mostly as rainfed crops, a fair degree of resistance to drought was insisted upon in the strains.

The third phase of millet improvement work consists of utilisation of knowledge of genetics in hybridisation work. For example, in the improvement of the quality of straw in *Cholam*, it was found that all the varieties of this State were pithy-stalked, while the *Patcha Jonna* of the Ceded districts was sweet and juicy-stemmed and was therefore well relished by cattle. Introduction of this desirable character in our varieties has been made by crossing these types and Co. 18 is the strain released. Work is in progress to introduce the sweet and juicy-stalked characters, which are governed by single genes, into all the strains. Short-duration strains have been evolved in *Cholam*, *Cumbu* and *Ragi* for cultivation during the irrigated season and these are liked for the smaller number of irrigations they require, as compared with the local varieties. In Ragi, a strain, K 3, which combines high yield, non-lodging character and resistance to *Piricularia* attack, has been recently released. A white-grained strain Co. 6, has been evolved by hybridisation combining high yield with white grains, rich in protein Outstanding work on the utilisation of hybrid vigour has been accomplished in cumbu and good hybrids of medium duration are under distribution. This pioneering work of crop improvement in India is modelled after the well-known work on maize in America. The noteworthy feature of this work is the evolution of a cheap, yet efficient method for the large-scale production of hybrid seeds. In minor millets, a few high-yielding strains have been released, while in pulses the crop improvement work was taken up late and only one strain in each of redgram, greengram and Bengalgram have been released so far.

The following is a list of strains released so far :—

Cholam	...	23
Cumbu	...	7
Ragi	...	9
Tenai	...	3
Varagu	...	2
Panivaragu	...	1
Pulses	...	3
Total	...	48

Much progress has, however, not been made on the agronomic side. Manurial experiments recently started, indicate that only straw yield is increased in cholam, while in cumbu, increased yield of both grain and straw are noted. The results require confirmation, as also data on the economic aspects of fertilising. Raising of a nursery and transplanting the seedlings in the case of irrigated cholam and cumbu have been found useful under certain conditions.

Future Work: It is the inherent quality of research that however extensive the achievement to date is, what remains to be accomplished is vast. Millets and pulses improvement work is no exception to this general rule.

In cholam, the great millet, there are three distinct varieties cultivated under rainfed conditions. The Periamanjal Cholam of the Coimbatore district is valued for its grain as well as its straw. Further improvement in the quality of straw is possible in this type and is proposed to be achieved by infusing sweetness and juiciness into the stem which is pithy. The straw of the high-yielding types is characterised by blackish-purple colour but cattle relish better the reddish-purple straw. To improve the quality of straw still further without affecting the grain yield, this linkage has to be separated. This variety yields best when sown in July-August and if the sowings are delayed there is a progressive decline in yield of both grain and straw. Evolution of a high-yielding, short-duration type which will suit the late season sowings is an urgent necessity. The *Talaivirichan* type is preferred for cultivation in areas of high rainfall, because of its loose-panicled nature. But this variety has the smallest grain among our cultivated types and its fodder quality also is very poor. These two main defects call for immediate improvement. In the southern districts of Tirunelveli, *Irungu*, almost a wild variety, is exclusively cultivated for fodder purposes. The grain of this variety is brown and is unfit for human consumption. Although the new strain K. 3 (extracted type of Periamanjal-Irungu cross) is useful as a fodder-cum-grain type, further improvement of the pithy straw by introducing juiciness is important. A white-grained variety of Irungu is grown in the adjacent districts of Madurai and Ramanathapuram for grain as well as fodder. The quality of fodder and the grain size of this type have to be improved. In the irrigated season, Vellai Cholam is commonly cultivated even though Sen Cholam is preferred in parts of Salem and Tiruchirapalli districts. A dozen strains have been released to suit the various tracts. Evolving a few cosmopolitan types combining high yield with quality straw will go a long way in assuring uniformity of produce as well as ease in multiplication, distribution and maintenance of seed purity.

Pests and diseases commonly found attacking the cholam crop in the State are the cholam ear-head bug *(Calocoris angustatus)* and the smuts *(Sphacelotheca Sorghii)* and *S. reiliana)*. Although effective insecticides and fungicides are available, it will be cheaper in the long run to cultivate resistant types. This will forestal any chance of the insects and pests becoming immune to the existing insecticides. For example we are led to believe that physiological strains of the ear-head bug immune to BHC. have already developed. Striga, a root parasite, is found in certain years to heavily infest the cholam crop. Preliminary

studies have revealed that resistance to this parasite occurs in an introduced sorghum variety which can be infused into many of our economic types.

Cumbu is cultivated over 1·2 million acres, but unfortunately it yields a fodder of very poor quality. If the ryots have any choice at all, this straw is not fed to animals, but is used only for thatching and such other purposes. Therefore, improvement in the palatability of cumbu straw is a matter of urgent investigation. Reducing the duration of hybrid strains without affecting the yield of grain is a possibility that deserves to be pursued. Spotting out of rust-resistant varieties has shown the possibility of infusing this desirable character into our strains.

Ragi, which ranks third in acreage under millets, is important for the reason that nearly 50 per cent of the area is raised under irrigation. It responds well to manuring and heavy yields upto 4,000 lb. of grain per acre are obtained. Evolution of a high yielding, short-duration, cosmopolitan strain combining non-lodging character and resistance to *Piricularia* is the immediate step in view. It has been found possible to infuse high protein content in Ragi and since the grain is consumed by middle and even upper-class people, because of its health-giving properties, further improvement in enhancing its nutritive value is desirable.

In minor millets, evolution of high-yielding types resistant to pests and diseases, with better fodder quality deserves immediate consideration. As already stated, intensive work on agronomic aspects is yet to be done. The optimum manurial and cultural practices, as also rotation and mixed cropping methods, that will suit different tracts have to be found out. Evolution of strains to suit different fertility levels is a necessary adjunct.

In advanced countries like the United States of America and Canada, with surplus food production, millets are mainly cultivated for feeding livestock. In the present drive for stepping up production, with emphasis on the spread of improved strains of cereals, better fertilising practices, assured water supply and with efficient plant protection measures, we may confidently hope to have a surplus production in the near future. It will be wise to foresee this eventuality and be prepared to face the situation. Fortunately the possibilities of using the additional production in numerous ways for the benefit of the country are already recognisable. Preparations of cereal breakfast foods, nutritive animal concentrates and industrial products like starch (by wet milling) readily suggest themselves. Breeding of strains suited for these specialised uses may however appear rather ambitious at this stage.

Pulses: Pulses are the main source of proteinaceous food for us, mainly because most of us are vegetarians, either by choice or out of economic necessity. But, the production of these in this State is very low. Immediate steps to augment the production by evolving suitable strains and efficient cultural and agronomic practices are problems awaiting solution.

On the extension side, much headway has yet to be made. The fruits of research like the evolution of strains, better methods of manuring, etc., have to be taken to the doors of the farmers and popularised. For example the improved strains of millets have barely covered 10 per cent of the total area. In the second five-year plan now being formulated it is programmed to cover 50 per cent of the area. An all-round effort in organising seed farms and in arranging seed distribution is necessary. The recently introduced method of village seed farms and voluntary seed exchange, tried in paddy and found successful, deserves to be extended for the spread of the strains of millets and pulses also.

Table showing nutritive value of grains of Rice, Wheat, Millets and Pulses.

	Protein %	Fat %	Mineral matter %	Crude fibre %	Carbo-hydrates %
1. Rice					
(a) raw, hand-pounded ..	8·5	0·6	0·7	..	78·0
(b) raw, milled ..	6·9	0·4	0·5	..	79·2
(c) raw, boiled and milled	6·4	0·4	0·8	..	79·1
2. Wheat ..	11·8	1·5	1·5	1·2	71·2
3. Cholam ..	10·4	1·9	1·8	..	74·0
4. Cumbu ..	11·6	5·0	2·7	1·2	67·1
5. Ragi ..	7·1	1·3	2·2	..	76·3
6. Tenai ..	12·3	4·7	3·2	8·0	60·6
7. Varagu ..	8·3	1·4	2·9	9·0	65·6
8. Kudiraivali ..	6·2	2·2	4·4	9·8	65·5
9. Panivaragu ..	12·5	1·1	3·4	2·2	68·9
10. Samai ..	7·7	4·7	4·8	7·6	63·7
11. Redgram ..	22·3	1·7	3·6	..	57·2
12. Blackgram ..	24·0	1·4	3·4	..	60·3
13. Greengram ..	24·0	1·3	3·6	4·1	56·6
14. Horsegram ..	22·0	0·5	3·1	5·3	57·3
15. Bengalgram ..	17·1	5·3	2·7	3·9	61·2
16. Cowpea ..	24·6	0·7	3·2	3·8	58·7
17. Lablab ..	24·9	0·8	3·2	1·4	60·1

From "Health Bulletin No. 23". The nutritive values of Indian foods and the planning of satisfactory diets—(1938) by W. R. Aykroyd.

Table showing the analysis of the straw of Paddy and major Millets.

	Ash %	Protein %	Oil %	Fibre %	Carbo-hydrates %
Paddy ..	16·3	3·3	1·5	30·5	37·8
Cholam ..	7·1	3·1	2·2	34·0	44·3
Ragi ..	12·1	2·2	2·4	28·2	44·9
Cumbu ..	8·1	1·9	1·3	37·6	43·7

(From Bulletin No. 33, South Indian fodders 1932 by P. V. RAMIAH.)

Cotton
Research and Extension in Madras State

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Before it is proposed to tackle the problem of the present paper of "Cotton Research and Extension in Madras State", it is necessary to give a brief account of what is already achieved in Cotton Research and Extension in the Madras State". In the symposium held last year a review of recent advances in Cotton Breeding Reseach in the Madras State was presented by Kalyanaraman and Santhanam and the progress in Cotton Extension Work was reviewed upto 1952 by Balasubramaniam in the symposium on cotton extension held in the Fifth Conference of Cotton-growing Problems in India by the Indian Central Cotton Committee, Bombay.

Cotton, an important commercial crop of Madras, is grown at present over an area of 8 7 lakhs of acres, with a production of about 2·7 lakh bales, both as an irrigated and unirigated crop. The American cotton, familiarly known as "Cambodia" in trade, was first introduced into Madras in 1906 and it is grown at present over an area of about 3·4 lakhs acres, of which about 1·5 lakh acres are grown under irrigation and the balance of 1·9 acres is raised as unirrigated crop. The *deshi* cotton known in trade as 'Tinnevellis' and "Karunganni" occupies an area of about 4·7 lakh acres. A small area is also grown to other varieties classed under 'Salems' over an area of about 65 000 acres. These constitute "Uppam" and "Nadam' which are being replaced by Cambodia or Karunganni cottons. Unlike the other States of the Indian Union, cambodia cotton is grown in Madras both as winter and summer-season crops. Since it is well known that in summer, the cotton crop gives not only a higher yield but shows superior fibre qualities, a great impetus is now given to grow cotton in summer as an off-season crop, wherever irrigation facilities are available. This off-seasonal cropping does not in any way affect the food position of the tract but enriches the cultivators by means of a cash crop. It may be stated with confidence that in the map of India, the Madras cottons viz. Cambodia and Karunganni will in future occupy a very prominent place. In yield of *kapas* the irrigated Cambodia ranks foremost and is capable of producing about a bale of lint per acre. Quality cottons like Madras Cambodia Uganda 1 and Madras Cambodia Uganda 2 are placed outside the purview

of price control by the Government of India, along with two other varieties of Bombay, viz. B. C. 134 and B. C. 170.

The development of cotton industry in the Madras State is influenced by two factor viz. development of mills and cotton research. The former sprung up in large numbers in centres like Coimbatore, with the functioning of the Pykara Hydro-Electric Scheme and shortage of cloth created during World War No. II. Of the 80 mills working in the Madras State, about 38 are located in Coimbatore district alone and the annual requirement of raw cotton to feed the mills of the State is estimated to be about seven lakh bales. In general the cultivators of Coimbatore, Salem, Tiruchi, Ramanathapuram, Madurai and Tirunelveli are highly cotton-minded and many progressive cultivators pay great attention to the cultivation of this cash crop .Yields as high as 2,000 lb. of seed cotton are recorded in the irrigated Cambodia grown in garden-lands under wells. On the agricultural side, both plant breeding and agronomic research have played a vital role in the improvement of yield and quality of the several varieties of cotton grown in the State. The progress of Cambodia cotton kept pace with the improvements of breeding technique, designed to bring higher yield, better ginning per cent, superior fibre qualities like length, fineness and higher warp counts. With the introduction of Cambodia 2 by pure line selection, the Cambodia bulk with a staple of less than 13/16″ and spinning 26 counts was upgraded to 13/16″ in staple length and spinning 33 counts. This strain was found to be highly adaptable to varying types of soil and suited many irrigated and unirrigated tracts of this State. As a result of intensive research and hybridization work, Madras Cambodia Uganda 1, which comes to maturity a fortnight earlier than Cambodia 2, gained popularity as a summer crop in the districts of Ramanathapuram, Tirunelvéli, Madurai, and South Arcot and is now recommended to be grown as a cold-weather crop in Coimbatore, Salem, Tiruchirapalli and Madurai districts also. This cotton is superior to Cambodia-2 in ginning per-cent (37), fibre length (1·00″ inches) and spinning performance (44 counts) and on account of its superior length is placed outside price control. As a result of further breeding research involving multiple crosses, another new strain, Madras Cambodia Uganda 2, was evolved in 1953 and this is now gaining popularity in the *Masipattam* area, replacing the former strain, Madras Cambodia Uganda 1, rapidly. This new variety is not only earlier than Madras Cambodia Uganda 1 by a fortnight but it is capable of yielding 18 per cent more of *kapas* per acre, with finer and longer lint, capable of spinning 50 counts or more. Similarly, in the winter area, strain 9030, from a multiple cross, is promising in ginning per cent, fibre length, fineness, higher spinning capacity and resistance to *jassids* and is expected to replace Madras Cambodia Uganda 1 very soon. Breeding researches in the summer cotton at Srivilliputhur

has shown that great possibilities exist to produce quality cottons comparable to the imported East African styles with a staple length of 1-3/16″. The reduction of duration of the improved varieties had a tremendous effect on the successful introduction of cotton in the summer areas as a rotation with paddy crop. Recent efforts made by the Agricultural Department on extending cotton cultivation in the deltaic areas of Tanjore met with success by the introduction of a still shorter duration variety like P 216 F, which could complete its harvest in five months yielding 1,000 lb. *kapas* per acre. This quality cotton is capable of spinning 40 counts and shows great adeptability over a wide range of conditions. Breeding researches are under way at the Agricultural Research Station, Aduthurai to evolve a still shorter duration, quality cotton capable of finishing in 4½ months.

Breeding work in Karunganni cotton has resulted in the evolution of Karunganni 2 and Karunganni 5 cottons by hybridization. These *Arboreum* strains are capable of spinning 30's counts as against 18–20 counts of local Tinnies and have now replaced the former strain Karunganni 1, evolved by straight selection methods. As a result of extensive hybridization work taken up recently, three long-linted cultures viz. 6186–9, 6874 and 6188 with a staple length of nearly one inch, and yielding more than Karunganni 2 or Karunganni 5 in the respective tracts have been isolated. One of these quality cottons, capable of spinning 40 to 42 counts will soon be released for the entire Karuganni and Tirunelveli zone of the State, covering about 4·5 lakhs of acres.

Research is under progress to acclimatise and successfully introduce Sea Island cotton in the West Coast of the State. Varieties like Montserrat and Andrews have indicated possibilities and with judicious transplanting and manuring, yields as high as 850 lb. of *kapas* could be realised on the poor *modan* soils of Malabar tract. The cotton grown in such areas is capable of spinning 100 counts, with a mean fibre length of 1·45 inches.

In addition to plant breeding research, agronomic studies on time of sowing and spacing, have furnished very valuable results in upgrading the yields of cotton. Early sowing and close spacing was in general found beneficial. In the case of Karunganni the harmful effects of *Irungu cholam* which precedes the cotton crop were got over by recommending indigo as a mixture with the cholam crop. In the case of manuring, application of ammonium sulphate as top dressing at 40 lb. nitrogen level in two split doses was found to be beneficial to the irrigated Cambodia crop and in the case of unirrigated cottons one dose at 20 lb. nitrogen at the time of sowing was in general benefical. In the attempts to find out varieties resistant to stem weevil of Cambodia, a perennial

Brazilian variety named '*Moco*' was found to be highly resistant and this cotton is recommended for growing in the backyards, of houses, waste lands, to meet the needs of extra-factory consumption. This perennial cotton with a staple length of one inch is capable spinning upto 50 counts and yields even upto 4 lb. *kapas* per plant under favourable conditions. Indents are being received every day for the supply of seeds of this variety from the various parts of India. Under mixed cropping, cotton-groundnut mixture, ragi-cotton mixture and chilli-cotton mixture were popularised and this practice served as an extra source of income to the cultivator.

With the above background it is now proposed to deal with the question of "What next in cotton research and extension in Madras State". This is indeed a difficult problem and needs considerable information regarding the potentialities of development, facilities available for expansion, demand, marketing, export and other factors. The future plans will have to be done with reference to the cultivation, trade and consumption by mills in a cash crop like cotton. According to the Second Five-Year Plan, the target of cotton production for the Indian Union is fixed at 55 lakh bales by the end of 1960–'61 and the share of Madras is 4 lakh bales. To achieve this production of quality cottons, which are much needed by the Indian Union to reduce imports and save foreign exchange, long-range research and short-term cotton extension schemes are aligned. The following are some of the points for consideration.

(1) In order to encourage the production of extra long-staple cottons the Indian Central Cotton Committee have agreed to fully finance such schemes for a period of 15 years and a scheme has been approved for Madras for the summer zone with the object of evolving extra long-staple American cottons with a staple length of 1–3/16″ and more. In the Winter area similar attempts have to be made to breed extra long-staple cottons in alignment with the progress of the summer cotton and the gap in quality between the cotton grown in two different seasons of the year in the State should be narrowed down as far as possible to avoid the chances of malpractices like mixing etc., that may arise.

(2) The production of extra long-staple cotton is at present attempted in this State, by hybridization of cultivated Americans, both inter-specific and intra-species and sometimes involving complicated crossing programmes. Since inter-specific hybridization between Asiatic and American cottons which differ in chromosome numbers have yielded successful results by back-crossing techniques in Bombay State in the release of strains like BC. 134 × Co. 2 and BC. 170 × Co. 2 which are superior long-staple cottons, serious attempts are to be made in the breeding programme of this State also, by hybridizing select lines of

Karunganni with various promising lines of acclimatised *Hirsutum* cottons, to yield early-maturing, high-yielding and long-linted types, resistant to pests, diseases and drought. It may be mentioned that some of the Surat Asiatic – American hybrid derivatives, 2196 (discovered by the senior author), BC. 125 x Co. 2 etc. were found to be highly resistant to *Blackarm* and *jassids* respectively but as they were found to be late for the conditions of Madras, further work is necessary in this direction to evolve suitable types.

(3) Potentialities for fibre length, strength, fineness and immunity to pink bollworm, *jassids* and *Blackarm* are exhibited in wild species of cotton like G. *thurberii*, G. *raimondii*, G. *armourianum*, G. *anomalum* etc. Although these cottons are as such useless for cultivation and many of them have no lint, when suitable crosses are made with the cultivated types and fertility induced and stability fully restored by techniques like colchicine treatment, back-crossing etc., exceptionally long-linted types resistant for pests and diseases may be obtained. Careful planning, and an intimate knowledge of cytogenetics and genetics are required as adjuncts to the normal plant-breeding programme.

(4) Another method by which the quality of lint could be stepped up along with high yield is by exploitation of hybrid vigour. Successful results in this direction have been reported both in Madras and Bombay States with a staple length of $1\frac{1}{4}''$ and an yield of 1,000 lb. of kapas (under Madras conditions) in the inter-specific cross Cambodia - 2 x Sea Island as a rainfed crop in the West Coast. Another advantage of the hybrids is that they can be continued as ratoons in the second year and yields as high as 1,500 lb. of seed cotton could be realised immediately without waiting for purification etc., normally practised in the plant breeding programme. Further researches are necessary and as suggested by Dr. Harland, various pure breeding lines of perennial *Moco* and acclimatised perennial *barbadense* types have to be utilised for further study to fully exploit the possibilities of heterosis in the production of extra-long-staple cottons. Care is however necessary in this kind of work to see that the seeds of F_1 hybrids are not utilized for multiplication. This project will have to be treated as a special one and the areas grown should be carefully demarcated; where other American varieties are not under cultivation. The chief problems in this work are the production of hybrid seeds in large scale every year and the high cost of production of seeds.

(5) In the attempts to improve the quality of Cambodia cotton, the problem of pests and diseases needs careful consideration. Pests like *jassids* and diseases like *blackarm* cause serious losses and have of late become items of regular study in the plant breeding programme.

Fortunately, some information is available on the mechanism preventing deposition of eggs on the leaves in the case of *jassids* by the work of Parnell and others. Hairiness of laminae is considered to be one of the major factors and the genetics of hairiness of laminae has been worked out by Knight and others. Research is still in progress to explain the *jassid* resistance in glabrous-leaved types like G. *armourianum.* Similarly in the case of "*blackarm*", a series of genes controlling the inheritance of resistance are involved and resistant varieties have been built up by Knight and others. Efforts are also made to combine *jassid* and *blackarm* resistance in the same plant. In the case of Madras Cottons also, such studies are necessary in greater detail in the coming years to build up types resistant to both *jassids* and *blackarm* as a whole-time study under the long-range programme. Under the short-term plan, the only possibility to control *jassids* is with the aid of pesticides like 'Endrin', 'Folidol' etc.

(6) In the breeding of American cottons, the problem of immaturity of fibres is an important consideration. A type which is immature tends to produee yarn which will be "neppy". Varieties which are least neppy and possessing high maturity percentage have to be synthesised through a survey of all types of cultivated American cottons and studying intrinsic fibre maturity in the wild cottons like G. *thurberii* and G. *raimondii.*

(7) In the programme of purification of varieties, the possibilities of building up perfectly homozygous lines by the exploitation of haploids in both the American and Asiatic cottons needs careful consideration. Haploid plants which have only one complement of chromosomes in the somatic tissues are rare and methods of artificially inducing it at will, just as chromosome complement in a plant is doubled at will by treatment with colchicine, will have to be attempted in the breeding programme. Likewise, parthenogenesis to induce the development of apogamic plants as recently discovered by Balasubramaniam by crossing *G. hirsutum* x *raimondii* hexaploid having 78 chromosomes with Karunganni cotton (26 chromosomes) needs careful consideration. The importance of such studies has been recently pointed out by Dr. Harland also, to isolate homozygous lines in cotton.

(8) On the extension side, it is necessary to multiply the approved strains in a pure state and in order to rapidly multiply the seeds to cover the entire tract, Agricultural Co-operative Societies should be organised in every taluk centre and they should act as official agents on the model of Bombay and Madhya Pradesh States. In this direction, one Cooperative Society has recently been organised to multiply and distribute seeds of Madras Cambodia Uganda 2 in Srivilliputhur taluk. State legislations like the Cotton Control Act, Cotton Growing

and Pressing Factories Act and 'Cotton Transport Act should be tightened up to prevent mixing up of varieties. By the implementation of the Cotton Control Act in stages the area under cotton in the different tracts will be fully covered with improved seeds in due course.

(9) The average low yield of seed cotton in this State and other States of the Indian Union should be up-graded by increasing irrigation facilities, manuring, application of pesticides etc, on a national basis.

(10) The cotton crop that is grown is at present valued mainly for its fibre and the seed is used for cattle food. In countries like the U. S. A. and recently in Pakistan, cotton seed is crushed and the oil extracted is used for many industrial and domestic purposes. In India, cotton seed oil is extracted in Punjab, Rajasthan, PEPSU and Madhya Pradesh States and the oil is used for Vanaspathi and the cake sold as cattle food or manure. The 'Linter' that is extracted from the seed after ginning is used in the manufacture of cellulose, carpets, ropes etc. Thus the seed that is used as cattle food in this State could be utilised for oil industry and the cake used for cattle food and manure. This step will not only help the cultivator in getting the maximum monetary returns for the cotton seed, but also helps in curbing the use of uncertified seed for sowing purposes. The Cooperative Societies will then be in a position to stock the full quality of sowing seeds with confidence and induce the cultivators to go in only for approved seeds sold by recognised agencies.

(11) Other factors like price support, export and import policies, regulated markets, and certification of lint will go a long way in inducing the cultivators to grow cotton over large areas and attain the targets fixed under the Second Five-Year Plan even earlier than expected.

The Future for Oil Seeds Research in Madras State

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Research on Oil Seeds is a recent development in the department of Agriculture of Madras State, and has been in progress only for the last twenty-five years, but the results achieved in breeding, agronomy, plant protection and other aspects of their cultivation are quite substantial. Intensive selection and hybridisation work in groundnut, gingelly and castor has resulted in the evolution of a number of strains with high yields, high oil-content and other desirable agricultural and commercial qualities. Amongst these, four strains in groundnut, three in gingelly and four in castor, have established their superiority over the local cultivated varieties. In coconut, which is a perennial plant with a high percentage of cross pollination, selection based on the characters of mother palms, seed-nuts and seedling progenies is being carried out in the promising ecological types. Hybrid vigour as a means of improvement has also been utilized in coconut by crossing the 'tall' and the 'dwarf' types to produce progenies possessing the desirable features of either of the parents like earliness, yield, etc. On the agronomic side, a few problems connected with these crops have been investigated. In groundnut the optimum economic spacing, manurial requirements, the best crop rotation, and remunerative mixed croping practices have been determined. For castor and gingelly, the optimum spacings have been fixed. In the case of the coconut, proper cultivation and manuring practices and efficient green manure and subsidiary crops have been fixed. From the investigations carried out on pests and diseases of the groundnut crop, effective control measures for the *'Surulpoochi'* pest and *'Tikka'* leaf spot disease have been found out. The correct stage of harvest that would ensure maximum yield and good quality produce have also been determined for these crops. The problem of storage of groundnut pods and kernels has been investigated and results of value to agriculturists and trade have been obtained. In spite of the fact that substantial progress has been recorded in the improvement of these crops, a large number of other problems connected with their cultivation still remain to be investigated. Only when proper solutions to these problems are found out, can it be claimed that oil-seeds cultivation and the industries utilising oil-seeds as a raw material have been established on firm foundations. Suggestions regarding the lines on which the future oil-seeds research in this State should be pursued to attain the above objectives are set forth in the following sections :

Groundnut: Though the improved strains now under distribution are heavy yielders with good quality produce, still they cannot be

claimed to meet all the varied requirements of the growers, consumers and industries. As far as the growers are concerned, there is an urgent need to evolve types resistant to drought, pests and diseases, amenable to mechanical cultivation and with short period of seed dormancy. With the increasing edible uses to which groundnut is put to, there is demand for a type with low oil content and high sugar content. In the *Vanaspathi* industry, the need for a type capable of giving colourless oil is keenly felt. For these reasons, breeding of new forms with special attributes like semi-spreading habit of growth, medium seed dormancy, low oil and high sugar content, white seed, etc., has become imperative. With these objectives in view, an intensive breeding scheme on this crop has just been initiated in this State with financial assistance of the Indian Central Oilseeds Committee. The nutritional aspect of the groundnut crop is rather a complex problem requiring thorough investigation. Though the normal nutrient requirements of the crop have been determined, still the economic doses of the nutrient elements and the changes brought about by them and other micronutrients under varied conditions of soil, need very careful study. A physiology scheme for carrying out comprehensive investigations on this aspect has also been started recently under the auspices of the same Committee. With the decline in prices of groundnut in recent years and growing foreign competition in the international markets, it has become increasingly necessary to reduce the cost of production of the groundnut crop to the maximum extent possible. Sowing and harvest account for a very large share of this cost. Use of labour-saving implements for these operations, including intercultivation, can be expected to reduce the cost of production considerably. Trials with bullock and tractor-drawn implements for carrying out the above operations have been taken up under a third scheme sponsored by the Oilseeds Committee. Work in respect of control of major pests and diseases affecting this crop and evolving strains resistant to them have to be carried out by adopting the latest breeding techniques.

Gingelly: The three strains now under distribution no doubt meet the requirements of the growers of the State for raising the crop in different seasons and under varying conditions of cultivation, but there is a great need to evolve cosmopolitan types that would come up well in all seasons and in all tracts. There is also a need to step up the present yield level of the crop by bringing together all the economic features now found scattered in different forms. A programme of cyclic crosses between selected economic forms has been started for this purpose and the work will have to be pursued rather intensively for achieving the desired results. The specific nutrient requirements and their optimum doses have still to be determined for this crop. Manurial trials aimed at securing this information have been initiated. Among the pests and diseases affecting this crop, the shoot-webber pest and the "phyllody" disease are the most serious and studies have to be pursued on their control both by chemical treatments and by breeding resistant varieties.

Castor: The strains of castor under distribution are outstanding in their yield performance. But on account of their long duration, they have not become as popular as they should be. The prospect of reducing their duration without sacrificing yield appears bright, as types with very short duration are found among the new introductions. To keep up the purity of improved strains under cultivators' conditions there is a need to impart some distinquishing feature to the standard strains so that the off-types could be easily recognised and removed. As hybrids between certain inbred types exhibit a high degree of vigour, with consequent increase in yield, exploitation of this vigour for production of hybrid seeds is a line of improvement worth pursuing. Work in this regard has been commenced and crosses between certain predominantly pistillate and staminate inbred forms have been attempted for fixing up the most suitable combination. As in gingelly, work has to be carried out on determining the nutritional requirements of the crop and an efficient rotation. The 'Semi-looper' caterpillar is the most dangerous pest, doing considerable damage to this crop. Any control measure against this pest will be a source of great relief to the growers.

Coconut: In recent years large-scale production of selected seedlings of the ordinary tall variety and of the Tall × Dwarf hybrids has been started. Exploitation of other promising exotic varieties like Cochin - China, Andaman Ordinary, Java, Philippines, etc.. and other fruitful combinations of T × D hybrids form the main programme of breeding in coconut. Determining the optimum and the economic doses of the manures to be applied to the palm at various stages of its growth is another important aspect requiring investigation. Bringing the vast stretches of unproductive gardens along the sandy coastal belt to a state of normal bearing by providing adequate manuring and summer irrigation (with the aid of filter-points) is yet another line which has great potentialities. This item of work is proposed to be taken up immediately at one of the Coconut Stations. As the results obtained from the trials on the West Coast Stations are not applicable in their entirety to the conditions on the East Coast, there is a real need to establish a regional research station for coconut on the East Coast also. Button-shedding, occurrence of barren nuts and effective control of the rhinoceros beetle are some of the other serious problems facing the coconut grower, on which systematic investigations are urgently needed.

The above review outlines the major problems connected with oil-seed crops that still await solution and the steps that should be taken to tackle them. Already there are signs of success in many directions. If these problems are pursued with zeal, it will not be long before the cultivation of oil-seeds in this State and the industries depending on them get well established, and open up new vista of prosperity for the Madras State as a whole.

Agricultural Research in Groundnut Cultivation

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Introduction: Modern agricultural science developed from the days of Liebig and Schubler in Germany, Boussingault in France and Lawes and Gilbert in England. Since then research in agriculture has made vast strides and other sciences like chemistry, biology, physics, etc., have also contributed to its development. Improvements by way of evolving new strains, new control methods against weeds, pests and diseases, etc., are also being effected year after year. The urge for bettering the achievements of to-day is growing and is bound to grow, as is reflected in the title for this year's symposium.

In the Madras State research in agriculture started from 1902, when an Economic Botanist was appointed for plant breeding. However, research on oilseeds, particularly on groundnut, was started in a full-fledged manner only from 1930. During the last 25 years great improvements have been made in the cultivation of groundnut in this State, much to the benefit of ryots. The recent advances in this field have been dealt with by Seshadri C. R. (1954). Improvements which are in the trial stage and which are sought to be effected in the field of agronomy and mechanical cultivation, with particular reference to groundnut are discussed in this paper.

1. **Improvements by Breeding:** Breeding strains for some special attributes besides high yield, is the foremost item in the improvement work on groundnut. With the greater knowledge acquired in the breeding technique suited to this crop it is possible by hybridisation to evolve new strains which combine desirable economic characters and high-yielding ability.

The bunch variety of groundnut is extensively grown in North Arcot District and Pollachi taluk of Coimbatore District. Its cultivation is gradually finding favour in other districts also, on account of its short duration and ease of harvest. Unfortunately, this type has a major drawback in the non-dormant nature of the seeds. Unlike the seeds of the spreading groundnut, the seeds of the bunch type do not require any resting period after harvest. If wet conditions prevail at harvest time, the mature pods begin to sprout in the field. The harvest of the bunch groundnut is possible only after rains and any delay in taking up this operation results in large-scale germination of the nuts in the field. It has

been reported from the bunch-growing areas that in certain years even upto 80% of the produce are rendered unfit for marketing due to sprouting of seeds. The seeds of spreading groundnut do not germinate immediately on maturity as they require a resting period of one to two months. There is therefore an urgent need to evolve a bunch type of groundnut with dormant seeds. This problem has been receiving attention at the Agricultural Research Station, Tindivanam and some progress has been made in this direction. After years of work a strain (AH 6481) has been evolved by hybridisation. The strain has a bunch habit of growth and dormant seeds. In the trials conducted at Pollachi the strain has shown superior performance. But its duration is longer than that of the ordinary bunch groundnut. More intensive work is necessary to evolve dormant bunch strains with short duration.

After the War, there is not much of export of groundnut and almost the entire production is utilised for crushing purposes. The growth of Vanaspathi industry in India has accounted for a large share in the internal consumption. In the manufacture of Vanaspathi or vegetable ghee, the groundnut oil has to be decolorised before hydrogenation, as the oil available in the market is coloured on account of crushing kernels with pink seed coats. A white-seeded type of groundnut will naturally yield a colourless oil, thus eliminating the need for decolorisation and refining, which are costly processes. A dirty white-seeded spreading type is available in the varietal collection maintained at the Agricultural Reseasch Station, Tindivanam. But it is not a heavy yielder and recently two white-coloured bunch types have been introduced from Australia and East Africa. These will be utilised for evolving white-seeded new forms.

Though India is one of the biggest producers of groundnut in the world, the per capita consumption of groundnut is very small, about 1-2 lb. In Madras State before partition, the per capita consumption of grouudnut was about 3 lb. In America, the per capita consumption for edible purposes is much more, being about 11 lb. There is therefore large scope for increasing the consumption of groundnut kernels in the State. Groundnut kernels are rich in nutrients and its popularisation among the masses will go a long way in improving the health of the people, especially of those accustomed to a poor cereal diet. The varieties that are at present cultivated on a large scale in this State are mainly commercial types suitable for crushing. The qualities that are usually preferred in a dessert-type are large, uniform size, good colour and low oil content. There are no forms in the existing collection which combine all these features and high yield. They are found distributed in different forms and hence by intensive selection and hybridisation work they will have to be brought together in one form. This item of improvement has already been initiated at the Agricultural Research

Station, Tindivanam and four promising strains are undergoing tests in cultivators' holdings. The performance of these in the districts is found to be encouraging and it should be possible to release one of them for general cultivation shortly.

2. **Improvements in Agronomy:** In this State groundnut is invariably sown by dibbling the seeds behind country ploughs, whereas in the Andhra State sowing is done with the country seed-drill known as *'Gorru'*. In foreign countries sowing is done with tractor-drawn implements in rows 2 to 3 feet spart. Till now the Department has been recommending a spacing of $6'' \times 6''$ for the bunch and $9'' \times 9''$ for the spreading groundnut. These spacings are obtained by adopting a seed rate of 100 lb. for the bunch and 80 lb. for the spreading. Row cropping as practised in Andhra and elsewhere has been found to be economical as it facilitates intercultivation and harvesting operations with implements. Experiments are under way to find out the effect of adopting wider row spacings between rows and closer spacing in the row. The results obtained during the last two years show that adoption of wider row spacing for groundnut results in higher yields and saving in expenditure for sowing, intercultivation and harvest. This practice should be made a regular feature in groundnut cultivation by intensive propaganda. It is estimated that if this practice is adopted even over a tenth of the groundnut area in this State, it will lead to a gain of forty lakhs of rupees to the groundnut cultivators.

The problem of manuring the groundnut crop has been receiving the attention of the Oilseeds Section for nearly two decades now. Results so far obtained show that the groundnut crop responds well to applications of potash and in certain years to phosphoric acid also. In recent years the trend in fertilisation is to supply all the ingredients required for the crop and not the only one to which it is partial. Complete fertilisers are more popular nowadays in foreign countries and also in this country. Years of trial have revealed that application of mixtures with low nitrogen, medium phosphoric acid and high potash, result in higher yields. A number of such proprietory mixtures with different proportions of NPK are in the market at present. A recent advance in fertilisation methods is the placement of manures in the zone wherefrom the plants could utilize them to maximum advantage. There is also economy in the use of fertilisers by resorting to placement. Methods of placement and implements for that purpose are under trial and the results will be passed on to the ryots in the near future.

The advantages of rotating groundnut with cereals in drylands have been well established. Demonstration plots in ryots, fields to bring home to them the advantages of such rotation are being organised in a number of centres in the districts. It is hoped that this groundnut and

cereal rotation will become a regular feature in this State and help the cultivators to reap maximum benefits. The practice of raising groundnut in wetlands after the harvest of the main crop of paddy is also becoming very popular. With increased irrigation facilities, the practice is bound to become more popular as it has already caught the fancy of the growers.

3. **Improvements in the Mechanical Cultivation of Groundnut:** The recent trend in agriculture is towards mechanisation. Whereas in other countries mechanical cultivation has made rapid strides, in India it is only in the initial stages. Groundnut cultivation with machinery is being tried at the Agricultural Research Station, Tindivanam from 1948. A separate scheme financed by the Indian Central Oilseeds Committee with the object of evolving tractor and bullock-drawn implements is also being worked out in this State. The results achieved so far are very encouraging and hold great possibilities for the future of groundnut cultivation in the State. A brief account of the achievements and work in progress are given hereunder.

(a) *Seed Drill:* These are designed on the model of the bullock-drawn mechanical seed drill for use with the tractor. Three or four such designs have been under trial and they have given encouraging results. With some minor improvements it is hoped to recommend an efficient drill for large-scale use with the tractor. These drills are capable of sowing an area of 12 to 15 acres in a working day of eight hours.

(b) *Tractor Guntaka:* Modelled on the H. M. guntaka No. 2, a tractor guntaka with 6-foot blade has been designed. Trials carried out with this implement have given satisfactory results even under adverse conditions of soil moisture. The implement is capable of lifting 8 to 10 acres of groundnut crop in a day.

(c) *John Deere (side delivery) rake:* This implement costing about Rs. 2,000/- was tried along with the groundnut harvester. It collects the harvested plants and leaves them in neat rows six feet apart. To a certain extent it takes out the pods left in the soil and brings them up to the surface. The power required for this being low, it can also be hitched behind the tractor guntaka.

(d) *Peanut Picker:* A peanut picker costing Rs. 3,300/- manufactured by Messrs. Ransomes and Jeffries Ltd., Ipswich, England and supplied by William Jacks Company, Ltd., has been under trial at Tindivanam since 1948. After extensive tests and modifications suited to local conditions, the machine has been giving more or less satisfactory performance. The harvested vines with the pods are dried for about three days in the sun and fed into the machine. The pods are

separated, winnowed, cleaned of mud, etc., and bagged. The picker is worked with a 5 HP oil-engine or from the belt drive of the tractor and can handle the produce from 10 acres in a day of 8 hours.

Trials are also in progress with groundnut pod and seed graders and groundnut hand-decorticators. These implements when perfected, will prove as great aids to groundnut cultivation in the State.

From the above review it will be seen that groundnut improvement work in this State has a very bright future and promises to place the industry on sound foundations.

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Castor Production in the Madras State

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Introduction: Castor bean has been an important item of commerce since olden times. For many centuries the oil has been used in medicine, in printing, dyeing and machine lubrication. Chemists have found new uses for castor oil and its derivatives. The products are in extensive use for the manufacture of paints, plastics, rayon, textiles, nylon, special lubricants, transparent soap manufacture and many other special items. Great strides have been made in this direction in other countries, but India is only making a beginning in this respect.

Of late, on account of its varied industrial uses, the importance of castor beans in international markets has been high. After World War II, the export of castor beans from India has dwindled, due to increased internal consumption. This has been made possible by the springing up of industrial concerns utilising castor-oil on a large scale.

The area and production statistics in India could be precisely known only since 1920–21 and even then the figures for the different years are not strictly comparable. They were of doubtful accuracy. However taking the face value of the figures, as compared with an area of nearly 1·8 million acres under castor in 1921–22, the crop covered only about 1·4 million to 1·6 million acres during the period 1922–23 to 1928–29. This declined later to less than one million acres by 1941–42. The declining tendency of the crop in the twenties, although the exports were generally on an increase, may be largely attributed to a fall in the demand for castor-oil in India, largely as a result of increasing competition of mineral lubricant oils.

As regards export trade, India has Brazil as a serious competitor in the World market. The conditions in Brazil are very favourable for castor bean production and that country is now the biggest producer of this oilseed in the World. Therefore, India can expect to export castor seed only if she can produce larger quantities at cheaper cost. However, one factor

favourable to India is that it has a well-developed castor seed crushing industry compared to Brazil and thus has scope for developing its export trade in this direction. At present, the scope for increasing the area to increase production is highly limited. Hence every endeavour is to be made to increase per acre production. This is feasible by adopting improved methods of cultivation, judicious manuring and sowing improved strains.

Much headway has been made in other countries in increasing the production of castor beans by mechanised farming in all stages of crop growth. However, in India the use of machinery in castor cultivation appears to be not feasible at present and the new frontiers open are the use of better seeds and adopting improved agronomical and manurial methods for increased production. The per acre production of beans in this State is as low as 226 lb. compared to 600 lb. in Uttar Pradesh.

Extension Work: In these days the problem of a breeder will be to impress upon the farmers, that his improved seed will really do well in the farmer's lands at little expense and trouble. So far a farmer has been content with selecting good seeds from selected plants and raising them after proper cultivation and manuring. Little does he know about the cross fertilisation of the seeds and their subsequent degeneration. Here research can do a lot and in increasing castor bean production in this State, the part played by hybridisation is going to be of primary importance.

Present Breeding Technique in Castor Crop Improvement in Madras State: (A) *Pure Line Selection:* The procedure adopted in this method is as follows:

First Year: Observation trials. New collections are sown with the already improved strain as check and studied. Plants showing desirable economic characters like good branching, long fruit clusters, compact setting of capsules, non-dehiscence, resistence to pests and diseases (by visual observation only) are selected. The selected plants are selfed by using close-meshed cloth bags of convenient size and selfed seeds gathered.

Second Year: Purity Study. The selfed seeds of the selected plants are sown in single rows and plants studied for purity of their morphological characters and incidentally their yielding ability. The unstable lines are rejected and promising pure lines alone taken for further study.

Third Year: Replicated row tests. The promising ones are raised in single rows under replicated conditions, adopting randomised block layout. The selections are compared with standard strains in respect of yield, duration etc. The yield data are scrutinised statistically.

Fourth year: Preliminary yield trials. Those that show promise in the replicated row tests are put under preliminary yield trials. The selections are sown in three-row plots (effective one row only) under replication for comparison with the standard strain. The yield data are analysed here also statistically.

Fifth year to Seventh year: Comparative yield trials: Selections that have done well in the preliminary yield trials are advanced to comparative yield test for three years. The selections are sown along with the strains in five-row plots under replicated conditions in which three rows only are utilised. The yield figures are subjected to statistical scrutiny every year and only those that are consistently recording higher yields are given out for trials in the districts. Qualitative studies are carried out from the preliminary stage on the produce of all the selections under trial with a view to maintaining a high standard of quality.

(B) **Hybridisation:** Producing improved strains of castor by breeding, takes a great deal of patient hard labour for about eight years, involving inbreeding and cross breeding. Complicated and tedious as this is, it is simple compared to the task of discovering that it could be done and how to do it. In self-fertilised crops an experimenter can depend on nearly all the plants to be like the parents but that is not so in a cross-fertilised crop like castor. The selected parents are purified by careful selfing for two generations. The inbred lines with the desired characters are raised alongside and hybridisation attempted. Selection of lines for new combinations are done in the progenies of F_2 and F_3 generations. They are then brought to purity studies and further work is similar to that indicated under item (4) above.

The evolution of better strains by breeding methods and the exploitation of hybrid vigour in castor may play an important part in this State in increasing castor bean production. The commercial production of hybrid castor beans has not been attempted so far in India, although it is in vogue in S. America. Nowadays

in most of the advanced countries the exploitation of hybrid vigour in many cross-fertilised crops has been successfully done and this may be considered as a new trend in advanced agricultural research.

Review of work done in other countries: At the Illinois Agricultural Experiment Station, the use of natural crossing plot in making castor been hybrid has been tried as far back as 1944 and 1945. The technique was similar to that used for making single crossess of corn, except that the pollen and seed parents were planted in alternative rows.

Yet another method evolved in the United States of America for commercial production was by three-way crosses. Here the pronounced pistillate character in a female line when sib-pollinated was found to segregate in the ratio of 1:1 for plants which have only pistillate flowers and plants which have the normal monoecious racemes. This line was used as a female parent in producing commercial F_1 single-cross hybrid seed. These pistillate F_1 hybrids suggested the investigation of three-way cross by scientists in America, for making commercial hybrid seed. The procedure involved for production of three-way hybrid castor beans is :—

(1) Cross the selected female line . to a selected male parent which would produce pistillate F_1 progenies. This female line was initially obtained by sib-pollination and types with well-pronounced pistillate character selected by roguing the off-types. Generally, upto eight rows of the female line can be satisfactorily pollinated when interplanted between two rows of the desired male parent.

(2) Cross the pistillate F_1 progenies obtained from the previous cross to a selected pollen-producing line with good combining ability. As mentioned above, planting upto eight rows of pistillate F_1 plants to two rows of the pollen line will be adequate. Since all the F_1 plants will be pistillate it would not be necessary to rogue normal monoecious plants as was the case in the initial cross.

Methods Suggested for Production of Hybrid Castor Seeds in Madras State: At the Agricultural Research Station, Tindivanam, inbred lines with the desired characters are available for the production of single cross as well as three-way cross hybrid seeds.

TMV I strain of castor is well suited for use as the female line in the single cross hybrid as the pistillate nature of the raceme

is well pronounced. This can be used as a seed parent. From the 140 inbred lines grown and maintained on the Agricultural Research Station, Tindivanam, suitable pollen parents can be easily selected. The pollen parent can be raised in each outside row as well as in alternate rows to that of seed parent lines. The seed parent may be emasculated before pollen is shed by hand. The emasculation process may last several weeks. The seeds in the female parents which are naturally hybridised may be harvested when mature and plants pulled down. To cut down the expenditure in emasculation the production of hybrid seeds may be limited to only the main heads, though this might result in reduced quantity of hybrid seeds.

Three-way Cross Hybrid Seeds: As already stated, the strain TMV I, is best suited as a female parent in view of the well-pronounced pistillate nature. It may be sib-pollinated and the resulting seeds sown. In the progeny consisting of the normal monoecious plants and completely pistillate plants, the former may be rogued. The completely pistillate line will be crossed to a selected male parent. The resulting progeny will have all pistillate flowers. The hybrid seeds obtained by this single cross may be crossed to another selected pollen parent. The hybrid seeds will be tested along with the strains in yield trials and their superiority over the strains under distribution will be established. The production of three-way cross hybrid seeds at this station on a large scale by the above procedure will go a long way in increasing the production of castor beans in this State.

Summary: Castor is not, of course, a major oilseed crop of this State, but it is grown to an appreciable extent in the districts of Salem, Coimbatore, Trichinopoly and North Arcot. Of late, the oil is put to varied uses and this is especially so in America. Important uses of the derivatives are for lubrication of jet airplane engines, all-purpose greases, hydraulic fluids, plastics and many others. The cake is also in great demand. The crop has a bright future. In the matter of world production Brazil is the largest producer, followed closely by India. To increase the overall production of beans in India and in Madras, the only way open is to increase the per acre yield, as no increase of acreage under castor is possible at present. The acre yield in Madras State is low compared to other centres and States.

Great strides have been made in foreign countries, in the exploitation of hybrid vigour and production of hybrid castor seeds by improved breeding techniques. The methods adopted by them are worthy of emulation in this State. The procedure to be adopted, for increasing the production of beans in the Madras State, has been indicated in the article. It is hoped that the production of hybrid castor seeds will help increase the per acre production in the Madras State in the near future.

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Sugarcane Research in Madras

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The opening of an agricultural research station at Samalkot in 1902, marked an era which led to the opening of the Indian Sugarcane Breeding Institute under the inspiring leadership of Dr. Barber. The crisis which the crop faced from *sereh* disease in Java and red rot in India stimulated new lines of research. After half a century of progress, the industry in Madras is now facing a second crisis, but it is hoped that history will repeat itself and sugarcane will record further progress.

Sugarcane presents many advantages to the research worker. For a breeder, it is a hybrid polyploid vegetatively propagated. It is both a plantation and a peasant crop. It can be cultivated only by resourceful ryots and requires good treatment.

The present and the future prospects are indicated below :—

Plant Nutrition: The sugarcane soils of United Provinces, Bihar, Punjab and Bombay are classified and surveyed on the genetic system. Varietal, manurial and cultural trials are now based on such trials. Investigations by Parthasarathy and Rama Rao (1951) indicated differential moisture uptake by the plant in clayey and loamy soils, wet and garden-land soils. Even though the clayey soil retains high moisture it does not easily part with it for the plant. Similarly, even when it is higher in fertility status, it is not efficiently utilised in clayey soils (Rama Rao, 1954). The inability of heavy soils to part with moisture and nutrients, necessitates higher doses of manure to be applied to them. The physical status of the soil is of great importance in the application and utilisation of artificial manures.

The complexity of transmission of applied manurial ingredients from the soil to the plant, necessitated the development of tissue tests, as better guides than chemical analysis of soil. Tests carried out at Anakapalle indicated that the levels of nutrients and moisture in plant tissues vary within a narrow range. This points to a fundamental mechanism in the tissues which regulate these levels. Foliar or tissue diagnosis may prove a better

guide to sufficiency or deficiency of nutrients than a direct study of the soils for the purpose.

Overhead irrigation was developed in recent years to save water. It is now known that sugarcane plant can absorb moisture through the leaf and pass it down to the roots (Van Dillewijn, 1952). Transpirating water takes up with it nutrient elements and the reversal of the process may leave the plant deficient in nutrition. But feeding the plant through the soil generally leads to wastage in the applied nutrients. It is now known that the leaf can absorb considerable quantities of salts in solution. Experiments with tagged elements indicated that the photosynthate of leaf moves rapidly to all parts of the plant, nutrients absorbed by leaf are rapidly distributed to all parts of the plant, nitrogen absorbed by root is redistributed to growing parts after three months and there is continual mixing of elements between tissues and all tissues are dynamic in exchanging old elements to new ones without altering concentrations. (Burr. 1953). There is not only quick transmission of elements by foliar feeding, but there is great economy in the same. This foliar feeding becomes necessary for the second and subsequent manuring when the crop is heavy and impenetrable. There is saving in manure by over 60 per cent (Sugar 47. page 64). Overhead spray irrigation leads to economy in water and leaves the soil in better tilth. By better distribution of irrigation water, sugar content in cane is increased. The use of anhydrous ammonia in irrigation water leads not only to economy in nitrogen but also to better distribution of the same (Baver & Humbert, 1953).

The high degree of negative correlation between moisture in tissues and sugar content was pointed out (Parthasarathy, 1951). The need for strict control of irrigation water was recognised more than two decades ago in Hawaii, but in earlier stages day degrees were adopted for irrigation control and in recent years leaf sheath moisture is adopted as guide. The possibilities of spray irrigation and foliar feeding may in future lead to considerable economy in water and a better distribution of nutrients and increased sugar content.

Interculture: Many of the intercultural operations, particularly in early stages of the planted crop, are designed to protect crop plants against weeds. In recent years selective weedicides have been used to kill broad-leaved plants. The annual and

perennial grasses are more difficult to deal with, although nut-grass is susceptible to 2, 4-D. The great potentialities of chemical weedicides are still to be developed in this State. A correct spraying schedule has not been worked out.

Planting in deep trenches, high banking, controlled irrigation, propping are all designed to minimise lodging in cane. Lodging brings many disadvantages in its wake and leads to loss in quality to the tune of 25% and in yield upto 40 to 50 percent. Detailed studies (Vaidyanathan, 1953) indicated that varieties differ in their reaction to lodging. Loss in sugar content in a variety like Co. 449 is much less than in Co. 419.

Resistance to wind is yet to be studied fully. In minimising lodging, cultural treatments are more important than other factors. In the Andhra area, canes are propped heavily, with 4,000 to 6,000 bamboos. Yet the clumps lodge badly, but that system facilitates lifting up the clumps to erect position. Cheaper techniques like stocking and trash twist propping (Parthasarathy and Reddy, 1951) are not efficient with very heavy crops. The cane plant is top-heavy and losses due to lodging are heavy even in a twelve-months crop. This factor had been mainly responsible for *adsali* and longer duration crops not being popular in this State.

Pests and Diseases: The early shoot borer *(Chilotraea infuscafellus)* and top borer *(Scirpophaga* sp.*)* are the two important pests on sugarcane in the State. The habits of the borers in the field and the broad cycles are yet to be studied in detail. The reaction of the cane plant to the infestation by early shoot borer was studied and reported (Parthasarathy *et al* 1953). Apart from variation in the degree of incidence between varieties, the reaction of the plant to the borer appears different. The two borers protect themselves from the earliest stages and spraying of chemicals may have only a limited significance. Systemic insecticides may be more intensively studied, to render the plant distasteful to the borer.

Among the diseases, smut is important. Pineapple disease of planted setts as affecting seriously the plant population appears to be widespread. The solution for smut appears to lie in the development of varieties resistant to it. Pre-treatment of setts

may not prove popular with ryots and as such treatment of the soil to protect the setts may have to be developed. In the alternative, systemic fungicides may have to be applied to the seed nursery crop.

Yield Trends: The crop yield competitions in Madras (Reports on development scheme) brought to light the heavy yields recorded by cultivators in the State.

TABLE I

Maximum yields recorded with Co. 419 variety

Centres	Tons per acre. 1951 – 1952	1954 – 1955
Gudiyatham	96	81
Nilakottai	87	74
Pugalur	69	84
Nellikuppam	...	129

Agrobiologists calculate 197 tons as the possible maximum yield of sugarcane and the world record in 129 tons in a 24-month crop. An yield of 129 tons cane per acre was recorded in Madras in a 13-month crop. In Hawaii, a change in variety contributed 40 – 45%, irrigation control 20 – 25%, and control of pests and diseases 10 – 15% towards the total increase in sugar yield from five tons to nine tons per acre. The basic factor is the establishment of a well-equipped research station. The amount spent on research in some of the cane countries of the world is shown below:

TABLE II

Country	*Staff*	*Substations*	*Expenditure*
Louisiana	136	5	$ 4,96,989
Hawaii	59	10	$ 8,21,216
Hawaii University Experiment Station	40	11	$ 2,61,188
Puerto Rico	67	3	$ 6,85,600
Florida	121	6	$ 5,90,961
Madras	...	1	...

Even if we were to consider 100 tons of cane of good quality as our potential, ths present average yield of the State is only 27 per cent. Compare this with the over-all efficiency of a sugar factory which is 85 per cent. The plant in the field is a better machine than the machinery of a sugar factory. The plants do not require repairs, replacements, fuel etc. and there is no breakdown and stoppage of functions. The field efficiency in agricultural production is therefore chiefly the human inability to understand mature. The plant must therefore be placed in its natural environment to grow at its best and the recent advances in sugarcane breeding in hybridising the cane plant with *S. spontaneum* and *S. robustum* are only preliminary attempts in that direction.

A change in variety is the first step in increasing yield. The Coimbatore Sugarcane Breeding Institute has done yeoman service in its field. Collection of a large number of *Spontaneum* types from the Himalayas down to Cape Comorin is a heroic attempt in utilising the wild type. It is true that after Co. 419 no new types were released. This need not dishearten any one. There is no genetic deterioration in cane (Dutt and Subba Rao, 1949) and any possible deterioration in yield should be checked by proper fertilisation and control of pests and diseases.

The equable climate of the southern end of peninsular India permits planting and harvesting sugarcane almost round the year. Researches are already in progress to develop a second season for Nellikuppam. Cultural schedules suited to the characteristics of varieties and season are to be developed (Parthasarathy, 1951).

Price Policy: Last but not the least, is the stabilisation of price. While it is so with all crops, it is particularly so for sugarcane. The clash of interests between the cane supplier and the factory owner necessitated fixation of minimum prices. This system of laying on weight of cane without considering the sugar content, encouraged cultural systems that depressed quality. The factories took no practical steps to step up recovery percent but demanded fixation of a lower price for cane. The general remark that payment on quality basis is not feasible is in correct, and should not be sufficient reason for continuing this incorrect cane price policy. Tests conducted at Samalkot sugar factory indicated the possibility of testing small units like two tons of cane. The cane area may be split into small zones or in the alternative, the hourly analysis of the primary juice may be related to the supply units

at the carrier for payment on quality (Parthasarathy, 1954). Unless the ryots participate in increasing sugar content of cane by an alteration of price policy, all attempts in that direction are doomed to failure. In Australia where extensive lands are available, sugar content in cane is increased without reference to yield. In our State, where pressure on land is high, increased production per unit of land is necessary but this should also be combined with quality of cane (Dutt, 1950).

Conclusion: The selection of a variety combining the high yield and softness of Co. 419 with the resistance to breaking and smut disease and high sugar content of Co. 527 is our future aim. The utilisation of the new *spontaneum* collections at Coimbatore may lead to this achievement at an early date.

The newer techniques of feeding the plant through the leaf for its moisture and nutrient requirements will lead to considerable economy in the applied water and manure for the cane field. The development of newer forms of nitrogenous manures like anhydrous ammonia and ammonium sulphate nitrate combined with foliar feeding reduce the danger to the soil by the residuary chemical radicals. Pests and diseases remain to be tackled through selection of resistant varieties. Borer pests, which are the most important ones in this State protect themselves from the very first stage of their entrance into the plant. Similarly, the smut fungus is protected. Systemic insecticides and fungicides are to be tried. The habits of the borers in the field and the brood-cycles require intensive study. A schedule of spraying weedicides as related to the habits and regeneration of weeds in the field must be developed to eradicate pernicious weeds like *Nutgrass* and *Trianthema.*

High yields are being recorded through increased application of fertilisers. The cumulative effects of removal of larger quantities of nutrient elements from soil, the cumulative after-effects of large doses of fertilisers and the susceptibilities of highly fertilised crop to newer types of diseases remain to be investigated. Sugar industry in India cannot prosper without the participation of the farmer in the sphere of profits. In this, payment for cane on the basis of sugar content is to be developed in one or two phases in the immediate future.

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What Next in Fruit Research and Extension in Madras State

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Introduction: The achievements and results of economic importance in the sphere of fruit research in this State over the past twenty-five years are of no small order. A brief review of the progress in fruit research and extension is presented in the paper.

Fruit Research: Fruit research in the State may be said to have commenced in the year 1941 when a separate Fruit Section was formed. The following are some of the notable results achieved so far.

(a) *Temperate Fruits:* Pruning methods suited to different bearing habits of apples, plums, peaches, pear and persimmons were determined. The problem of mild winters and woolly aphis was got over, the first by linseed oil emulsion and Sandolin "A" Sprays and later by use of resistant Merton rootstocks. The pollination behaviour of plum varieties for recommending best inter-planting and top-working practices, a quick method of ripening persimmon fruits are some of the other results.

(b) *Sub-tropical fruits:* Citrus received major attention. Many of the results of research on this crop have passed into growers' practices. Lemons were popularised. Varietal introductions and devising suitable propagation techniques are the other achievements in other subtropical fruits, such as fig, pomegranate, avocado, passion fruit, etc.

Tropical Fruits: Work on tropical fruits was intensified. Evolution of new types through hybridisation in mango, purification in papaya, regulation of fruit harvests in pineapple through hormones, clonal propagation of cashew, optimum propagation techniques for all, including selection of suitable rootstocks are some of the major achievements.

Fruit Extension work: Horticultural extension work in the State is of very recent origin. For several years, it consisted only

in furnishing information and advice on specific problems and reached only some well-informed and enterprising growers. Since 1948, the work has been expanded with the initiation of a post-graduate course in Horticulture and with the establishment of four Model Orchards in representative fruit-growing regions.

The Future in Fruit Research: The review of past work highlights problems, areas and subjects that need further attention. The following suggestions may be given to further the cause of fruit development in the State.

(a) Importation of varieties from other countries to enrich collections. Systematic plant introduction on a well-regulated basis would immensely benefit the horticultural industry.

(b) Application of plant hormones and chemicals to the solution of specific problems in particular fruits (e. g.) difficulty to establish young transplants and incompatibility in grafting in mangosteen.

(c) Evolution of maturity standards and research on the usage of mechanical contrivances for judging correct maturity of fruits.

(d) Research on the utilisation of horticultural by products.

(f) There are several other problems specific to particular fruits, the solution of which would go a long way in the development of the fruit industry as a whole on sound economic lines. These include reinvestigation of propagational aspects, research on manurial and water requirements, plant protection in fruits, study of root-stocks cultivated and wild, etc.

The Future in Fruit Extension work: Madras State has done pioneering work in fruit extension work as already indicated. A net-work of ten more Model Orchards are proposed under the Second Plan. These are long-range measures. But short-term measures are necessary for speedy transmission of available data. A few of these are:—

(a) Organising fruit shows and exhibitions in different parts of seasons as a regular feature year after year.

(b) Periodical meetings in fruit-growing centres between research staff, extension workers and growers.

(c) Opening fruit parlours in railway stations and in central places in cities and towns with a nice display of scientific information.

(d) Publication of results in regional languages as handouts, press releases etc. and their door to door distribution.

(e) Imparting horticultural instruction in schools and colleges by special lectures by experts and film shows etc. Film shows may also be held in public cinema halls. Production of such feature films will have to be done by the Government.

(f) A separate Directorate in Horticulture will be necessary to put into operation the full programme of fruit research and extension.

Banana Research

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Introduction: Planned research on problems of economic importance in bananas is only of recent undertaking in India, as it started with the commencement of the Banana Research Scheme in Madras, Bombay and West Bengal States with financial assistance of the Indian Council of Agricultural Research. In a country which claims the origin of this important tropical fruit and which is unequalled in its extent of its varieties, banana research has not attained much headway. In this respect the results achieved at the Imperial College of Tropical Agriculture are widely known and particularly in systematic studies, the contribution of Cheeseman is an outstanding one.

Systematic Studies: This aspect has attracted most of the foreign workers and yet it is a problem which bristles with complications. The confusion in banana systematic studies orginated with the inclusion of certain indefinite and varying characters in the description of species by Linnaeus in *Musa paradisiaca* L., as having persistent male phase, culinary quality of the fruits and loose bunch with fruits held in lax manner and of *Musa sapientum* L., to include all edible varieties except the Cavendish group. There were a few other botanists who held the view that *Musa paradisiaca* is only a sub-species of *Musa sapientum*. Such theories have been dismissed by Cheeseman (3) as not well-defined nor botanical. He postulates that the cultivated banana varieties (triploids) of *Eu-Musa* section have originated from the wild species *Musa balbisiana*, Colla and *Musa acuminata*, Colla. It is further observed that many of the best dessert varieties like Gros Michel have more of the characters of *Musa acuminata*, while a few show relationship to both the species. *Musa sapientum* can be said to be the last group which has the combined characteristics of *Musa acuminata* and *Musa balbisiana*. Therefore the fruit quality of dessert bananas is traced to *Musa acuminata* and the characteristics of cooking varieties generally associated with *Musa paradisiaca* are now taken to be distinctive features of *Musa balbisiana*. However Cheeseman and other workers are for the present in favour

of retaining the specific name of *Musa paradisiaca* L. These two species *Musa paradisiaca* and *Musa sapientum* are best considered as type species and at present carry negligible significance in nomenclature and classification of banana varieties.

Taking the line of demarcation of the different sections of the genus *Musa*, Cheeseman's findings have not been accepted *in extenso* by others and may require revision. His distinction of various characters between *Musa balbisiana* and *Musa acuminata* may have to be regrouped. From the observations made at the Central Banana Research Station, Aduthurai, it is seen that the partitioning of the *Callimusa* section, at least for certain well-known members like *Musa coccinea* from the *Eu-musa* section, lacks precision. Even in the chromosome number of certain species Agarkar and Govindaswami (i) have differed from Cheeseman.

In South India systematic work on bananas received a good deal of attention by Jacob (4) and subsequently by Venkataramani (5). Jacob's observations and descriptions are no doubt valuable. However, his coining of new species as *Musa sapidisiaca* Jacob K. C comprising the cultivated varieties of South India, though appreciated by workers in Kew, at best recognises the natural hybridity of cultivated bananas, but does not indicate the correct specific status of the varieties. The second aspect of the problem peculiar to this country especially, because of different dialects and languages, is the bewildering array of synonyms in the nomenclature of varieties. This problem can be solved only by studying the varieties in different situations and all the varieties at one central place. This has been attempted at the Central Banana Research Station, Aduthurai and it has been possible to reduce 126 varietal names to 55 distinct varieties, based on specific distinguishing characters. So our main objective should be to have an exhaustive national collection of banana varieties of India and from foreign countries so that the studies can be pursued on more fruitful lines.

Hybridisation: Cytological studies on bananas have received much attention in the hands of foreign workers, in the last three decades. In Trinidad, Cheeseman and his colleagues initiated breeding work on new varieties along planned lines although he has not attained complete success in evolving a variety completely resistant to the virulent Panama-disease and at the same time possessing the economic characters of Gros Michel. This work is still in progress. In banana hybridisation, selection of suitable

male parents is an important question and in this country we have got a good number of bananas occurring in the wild state and in diversified forms. The aim should be to improve the keeping quality of the fruits, dwarfness or semi-tall nature and resistance to the Panama wilt and Bunchy top diseases. Especially in the Coromandel Coast, where cyclones are not infrequent, the evolution of semi-tall varieties of the popular varieties, *Monthan* or *Poovan* will be of great economic advantage. Initial studies at the Central Banana Research Station, Aduthurai proved that such a hybrid of intermediate characters is possible and an interspecific hybrid of *Monthan* x *Musa coccinea* was obtained. But the hybrid could not be utilised for further breeding because of female sterility and absence of pollen. In India cytological studies of bananas received some attention at Poona (1) and Calcutta (2). However, the studies were not pursued fully. In a country where wild species occur in abundance, there is a vast scope for research in evolving new varieties. The Western Ghats of Madras and Bombay states contain many wild bananas, showing large variations and forms of *Musa acuminata* especially and with such potentialities there is a real need for the continuation of systematic and cyto-genetical studies.

Sports in Bananas: Apart from hybridisation, obtaining varieties with desired characters in bananas is possible. Bananas are highly variable and unstable in character and mutations and abnormalities recorded in bananas are many. Since vegetative propagation is the rule in this fruit, perpetuation of such clones of desirable characters is possible and the degeneration and reversion of some characters are also equally possible. "*Pedda Pacha Arati*" is a semi-tall mutant of the dwarf variety, Mauritius and so also it is reported that the Australian varieties "*Mons Marie*" and "*William's Hybrid*" are the semi-tall mutants of the dwarf Cavendish. *Pedda Pacha Arati* has now become very popular in Malabar. Ecological variations are not rare in bananas. "*Sirumalai*" and "*Virupakshi*" are the well known eco-types of "*Vannan*" and the modifying influences of various environmental factors are being studied during survey tours under the Banana Research Scheme. Such variations also throw light on the acclimatisation and adaptation of certain varieties to suitable localities. In pursuance of that objective, the performance of different varieties is proposed to be studied at the various Agricultural Research Stations of our state. These studies will enable zoning of the varieties to different regions in Madras State.

Propagational Studies: Studies made at the Central Banana Research Station show that sword suckers of both *Monthan* and *Poovan* varieties flower and fruit earlier than broad-leaved suckers. Nursery and field investigations show that it is quite possible to use bits of rhizomes of parent plants as well as daughter suckers of bananas as useful material for propagation. The advantage of early and quick propagation by bits of rhizomes is almost negligible under Aduthurai conditions as the annual increase in area by fresh plantation is little for which fully developed banana suckers from the existing plantations are always available in excess. The real advantage will occur only when a superior variety is evolved or introduced which required easy multiplication and spread.

With regard to the selection of suckers, one more consideration arises viz., at what stage of the mother plant the suckers have to be allowed and separated for planting elsewhere. The studies on this aspect has just been initiated at the Central Banana Research Station, Aduthurai.

Plantation Practices: Among the plantation practices the manurial requirements of the crop is a vital problem. Past trials in this direction conducted at the various Agricultural Research Stations have not been on a co-ordinated scale. The results of the manurial trial in the wetland area of the Central Banana Research Station with the *Poovan* variety have shown that the best manurial dose per plant is given by the treatment in which $\frac{1}{4}$ lb. nitrogen is applied as cattle manure and $\frac{1}{4}$ lb. as ammonium sulphate in two doses, the first dose three months after planting and the second five months after planting, in addition to the basal dressing of 25 lb. cattle manure per plant. Under Aduthurai conditions of heavy clay soils there was no response to potash and phosphoric acid. As the next step with the above results, a trial at the Central Banana Research Station, Aduthurai is under way to determine the exact time of application of manures, especially ammonium sulphate and its influence on the flowering of the plant.

Besides the time of application of fertilisers and its quality, the method of application of manures deserves special attention in bananas. Usually the basin system of application is practised. However one disadvantage in that practice is that it may retard the root penetration and thereby the anchorage of the plant is impaired and consequently they become susceptible to wind havoc. To obviate this difficulty and to mechanise the manurial applications trench

manuring is sometimes adopted in foreign countries. Such a system, it is claimed, induces the roots to go deep. How far this system of manuring is suitable to our perennial system of cultivation has to be investigated.

The role of micro-nutrient elements in bananas has not been investigated so far. It is a common sight that the margins of the laminae of certain banana varieties show a scorched appearance and this feature has not been studied, though is quite possibly due to a deficiency in one or more of the trace elements.

To determine the manurial requirements of a crop, investigation in one or two centres will not be sufficient as the results are necessarily limited to identical soil types. A co-ordinated programme has to be chalked out to initiate such trials in representative tracts.

Diseases: Without the mention of Panama disease, a review of the research on bananas would be incomplete. Hybridisation work carried out in Trinidad to combat this disease has not yielded full benefits. Fortunately some of our important varieties 'Poovan' are highly resistant to Panama disease. But the problem does not end there because there are equally susceptible varieties like "*Rasthali*". It has also to be noted that Panama disease which was unheard of a few decades ago, is slowly making its appearance in some tracts of this country. As such, systematic and rigid enforcement of quarantine measures, coupled with the elimination of susceptible varieties in cultivation have to be adopted. From onwards, breeding to obtain disease-resistance in varieties have to be started on a planned scale before the disease commences to tell on our banana industry.

Hill bananas stand on a different footing and deserve special consideration. Research on the problems of hill bananas has not commenced and this lacuna in banana research needs immediate attention. Madura district of this State holds a monopoly in hill bananas and there is a well-organised industry flourishing there. An approach has to be made in good time to tackle the problems obtaining there.

The problem of marketing of bunches of banana has not received adequate attention as in other countries. The entire production is consumed within the country and nothing is exported. But in foreign countries, like the Carribean Islands, bunches are sent to European countries and Gros Michel is eminently suited for such

transport. However, such problems have not arisen in this country. But the wastage in marketing can be minimised by the correct stage of harvesting and packing the bunches properly. In Queensland banana covers of plastic film are found to be very useful in improving the quality of the fruit. Trials with Indian varieties should also prove useful and a beginning has been made in that direction at the Central Banana Research Station, Aduthurai.

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What Next in Soil Science

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Introduction: Soil is the basis of all agriculture. Although it has been shown that vegetables and some other crops can be grown in water cultures it is on the soil that agriculture all over the world depends. Soil not only gives support to the plants and trees growing on it, but it is from the soil that plants take the major part of the nutrients and water required for their growth and reproduction. It is on the produce of plants that men and animals live. Soil is therefore very important and has been studied from time immemorial in order to increase and maintain its productivity.

During the last decade soil science has made tremendous progress in every aspect, physical, chemical and biological, as compared with previous periods. In some cases the change has been almost revolutionary.

According to the modern concept of soil science the colloidal complex is the seat of most of the changes taking place in the soil and is therefore of paramount importance. Emphasis is also laid on the role of biological agencies in the soil. In fact the study of soil science to-day calls for a colloidal-biological approach to the manifold problems confronting the soil scientist. The plants and the colloidal complex in a soil are so intimately connected that they form a part of the soil system. For a proper understanding of this complicated system intensive research has to be carried out in regard to the various components of the soil mineral matter, the process of humus formation and the change it undergoes and the nature and activity of the macro and micro-organisms, with their enzymic inter-relations. All these aspects still remain to be fully understood for arriving at reliable conclusions on soil fertility and crop production.

Factors Influencing the Growth of Higher Plants: The growth and development of plants, as is well known, are dependent on various factors, internal and external. The external factors which are of importance are (1) light; (2) mechanical support; (3) heat;

(4) water; (5) air and (6) nutrients. Except in the case of light, soil is the medium for the supply of these factors for plant growth. The interaction of these factors and their resultant effect on crop growth are still not clear. The problem of balanced manuring for efficient crop production with reference to different soil types, climatic conditions and water resources has to be studied further. We know certain elements must be present in a soil in available form for the plant. Apart from their presence their concentrations in relation to each other must be adjusted properly for ensuring good and healthy crops free from diseases. Physiological balance is one of the important objectives of sound fertilizer practice. Knowledge of this aspect is at present scanty and much work has to be done in this direction. The mechanisum of the release of plant nutrients from soil particles to plants and the relationship between micro-organisms and plants have to be studied further in detail. With regard to plant nutrients the following four factors have to be examined. (1) the quantities of the various primary and minor elements required for maximum crop production, (2) the forms in which they are present in the soil (3) the extent of their availability and (4) pH and soil solution.

A few of the important aspects on which soil research is to be directed and the problems of practical importance to agriculture that have to be tackled on the basis of theoretical knowledge gained so far, are dealt with briefly in the present paper. The study of many of the intricate problems of soil science has become possible on account of the development in recent years of refined methods of attack such as spectrography, X-ray analysis, tracer technique involving the use of radioactive isotopes of manurial elements etc. Chromatography is also being pressed into service in soil analysis.

Soil Colloids and Plant Nutrition: Clays and with them soils, differ widely in their cation exchange capacities. Montmorillonite - Kaolinite, illite - and hydrous oxides groups are the four broad classes in naturally occurring clay. The cation exchange capacity for unit weight of these groups decreases in the order stated. The colloidal complex governs such important factors at soil pH, degree of ionic saturation, ratio of cations, influence of these on the activity of absorbed ions and the effect of these on the metabolic activity of the plant. The colloidal complex brings about a selective absorption of nutrients supplied and partly influences the reaction of the soil.

Plants vary widely in their capacity for producing plant material consequent on the intake of unit doses of nutrients. The amount of dry matter produced by absorption of 318 lb. of N (maximum amount usually taken from 1 acre of soil) is found to be 6 tons for soyabean forage, 13 for corn and 56 for sugarcane. Research on this aspect of production of different amounts of plant material by different plants for unit nutrient doses should yield profitable results.

Micro - Organisms and Soil Fertility: The soil is teeming with life. The innumerable number of different forms of micro-organisms in the soil contribute not a little towards soil fertility. Any condition that adversely effects their growth and activities is bound to bring about undesirable changes in the soil. Again, it is not all organisms that are favourable for plant life. Some are definitely harmful causing diseases to crops. Knowledge of these organisms and their control by proper soil management deserves attention. A few other organisms, while not causing disease, may affect crop growth by competing with plants for availabe plant food.

In addition to the competition for food there is another type of microbial rivalry. Thus certain bacteria, fungi, actinomycetes have the power to produce substances that will inhibit or kill other microbes. The ability of certain micro - organisms to produce antibiotics has brought about revolutionary changes in the treatment of many serious human and animal diseases. Several preparations containing specific ingredients such as penicillin, streptomycin, aureomycin, are now available to cure diseases. Although the soil harbours many disease - producing organisms it is also a source of life - saving drugs.

The activity of microorganisms sometimes help each other. Certain groups of organisms produce metabolic products which serve as a source of food to others. As a striking example of this is the release of ammonia by certain bacteria. This is a source of food and energy to nitrifying bacteria. The series of inorganic transformations taking place in the soil such as ammonification, nitrification, production of sulphate etc., are so complicated that they are still not fully understood. The chemistry of humus formation and compost preparation is also exceedingly difficult to explain. Problems relating to the mechanism of nitrogen fixation by symbiotic and non - symbiotic nitrogen - fixing organisms in the soil are also not fully understood, but great benefit can accrue if the

symbiotic and non-symbiotic nitrogen fixing bacteria are efficiently utilized. The significance of carbon-nitrogen ratios and their bearing on soil fertility has to be studied in detail with reference to crop growth, climate and rainfall. In the biological field, we have little information about the nature and extent of the different forms of micro-organism aud their role individually and cumulatively on the numerous physical, chemical and other changes taking place in the soil. Methods for the satisfactory classification of the soil micro-organisms into distinct groups based on their nutritional and other requirements and in relation to their importance in the maintenance of soil fertility have to be worked out.

Plant Nutrients and their Availability in Soils: Among the primary plant nutrients, nitrogen, phosphorus, potassium, phosphorus is by far the most difficult to deal with. The inefficient utilization of phosphorus by plants has long been known, especially in laterite and lateritic soils. The experimental use of radio-active phosphorus has recently emphasized the point even more thoroughly. By adding fertilizers containing tracer phosphorus it is possible to determine the proportion of applied phosphates absorbed during the year of application. This technique will have to be applied to ascertain the fate of phosphates added to the soil and to follow the changes taking place in the phosphorus absorbed by the plant.

Potassium is present in most of the soils of the State in adequate amounts, except in the soils of the West Coast and the Hills, but most of the crops grown in the State do not respond to potash fertilization.

The soils of the State are generally deficient in nitrogen and methods of increasing the content of the soils with regard to this nutrient must be explored.

The placement of phosphatic and nitrogenous manures should be studied to obtain the maximum return from the nutrients. A proper balance of the three essential plant food materials nitrogen, phosphorus and potassium has to be worked out for different crops in the various soil-climatic zones of the State.

Trace Elements: Numerous trace elements in minute amounts have been found to be essentiol for optimum plant growth. Of these, the more important are iron, manganese, copper, zinc, boron and molybdenum. Except for iron, trace elements are found sparingly

in most soils. Every year the crop removes small quantities of this natural reserve and crop production over a long period depletes the soil to such an extent that many areas in the world suffer from trace element deficiency. The roles specific of trace elements in plant nutrition and our knowledge on these with reference to our soils and crops is very little.

Work that has to be taken up in the Chemistry Section: Some of the major items of work of great significance that has to be undertaken in the State are the following:—

(1) The reclamation of saline and alkali soils.

(2) Soil survey and efficient land utilization.

(3) Efficient use of fertilizers with reference to water supply, soil types and crops.

(4) Application of latest methods and techniques in the elucidation of problems in soil science such as rapid soil tests, tissue tests, sprectrography, chromatography, and the use of radio-active isotopes.

(5) Systematic field experiments with major and minor plant nutrients to evolve suitable fertiliizer mixtures for different crops in the soil-climatic zones of the State.

(6) Cultivation of inoculated legumes in rotation with cereals for the enrichment of the soil in respect of nitrogen and organic matter and for structural improvement (tilth).

(7) Prevention of soil erosion.

(8) Conservation of soil moisture for plant growth in regions of scanty rainfall.

(9) Study of the clay fraction of the soil types.

All these items are important for the advancement of agriculture in the State. The first item, namely the reclamation of saline and alkaline soils is easy of attainment and if the large areas of such soils present in the State can be improved and put to crops agricultural production can be considerably enhanced. Our knowledge of base exchange can be utilised for the purpose. It has been shown at Mettumarudur in Trichinopoly district that even the worst type of alkali soil, where not even grass will grow, can be made to produce over 3000 lb. of paddy per acre and that the method of reclamation must depend on the nature of the soil. So a survey of the extent

and nature of the saline and alkali soils in the State is imperative. After this, suitable blocks of alkali land with good water resources can be taken up and reclamation experiments carried out with different soil amendments. A separate technical staff with sound knowledge of soil science should be appointed for this important work to enlarge the cultivable area in the State.

As soil is very important in agriculture, it is necessary that an inventory of the soils of our country should be made. The purpose of such an inventory is to classify, and study the soil types so that they can be put to best use. There are several other purposes served by soil surveys. The soil survey of some parts of the State have been made twenty five-years ago and earlier. These surveys had as their object the manurial requirements of paddy tracts. So the soil and sub-soil to the depths 0-9″ and 9″-18″ only were studied. As is well known, the unit of study of the soil at the present time is the soil profile i. e. the succession of soil horizons from the surface down to the parent rock. So the earlier soil surveys are not useful now to understand the soil fully. It is therefore necessary to carry out soil surveys of at least the important tracts of the State. For this purpose, there should be a permanent organization attached to the Agricultural Chemistry section. The organisation or soil survey party should undertake detailed soil surveys and map out the soils in each of the soil climatic zones. The party should be given the necessary equipment and transport facilities.

Variations in Crop Yields

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Introduction: The main aim of all agricultural research workers is focussed on the problem of maximisation of crop production with minimum cost. Evolution of yielding strains, formulation of economical and profitable manurial programmes, utilisation of labour-saving implements, economic use of water for irrigation and tapping to the maximum extent all the avilable irrigational sources including underground water, have all received their legitimate and proper attention at the hands of agricultural research workers in different parts of the country. Of late a relative study of the merits and demerits of the method of cultivation adopted in different countries has also received their attention. The adoption of the Japanese method of rice cultivation in India is a typical example of this aspect of agricultural research.

Now it is imperative to study the causes that depress the yield of crops inspite of having access to high-yielding strains and all other practical aids and facilities for their proper cultivation. An analysis of the variation of crop yields in different zones will reveal that the main causes for this variation are (i) failure of rains at critical growth-periods of crops, (il) loss of crops due to pests and diseases and (iii) loss to crops due to weather abnormalities like cyclones, hailstorms, heat waves, frost etc.

Timely Rains: An analysis of the findings of agricultual research workers will reveal the great importance of timely rains in sufficient quantity received in an ideally distributed manner during certain critical growth-phases of the crop. In Australia, data have been collected to prove that half-an inch of extra rainfall at the time of germination of wheat benefits the farmers to the extent of about one million pounds of extra wheat grain.

Cultivation of crops, particularly in rain-fed areas, still remains a gamble with the monsoons. This is due to the failure of rains during critical growth–periods of the crops. The farmers want rains only in small quantities, but at the right time, when their crops are in real need of rains. To explore the possibility as

to how best the needs of the farmers can be met in this direction, the Madras Government propose to launch on a scheme of 'Artificial Rain-making'.

A detailed resume of the various techniques adopted to create artificials rain in different contries is outside the purview of this paper but the techniques include direct spraying of chemicals and dropping of ice crystals in the cloud region, using aircraft and also shooting smokes with various chemicals like silver iodide, calcium chloride, sodium chloride, etc., by using ground furnaces and also by balloon technique. In the experiments to be conducted in Madras State, all the known techniques, with the elimination of aircraft for the time being, are proposed to be tried to study their relative merits under the conditions prevailing in different parts of the State.

Loss to Crops due to Pests and Diseases: The pathologists of the Agricultural Departments in the various States have very effective prophylactic and remedial measures for various pests and diseases. In addition, they have gained a clear conception of the life-history of pests, their host plants, periods of activity and inactivity and so on. Similarly, in the case of diseases too, the origin and nature of damage to crops have been understood clearly. It is now evident that these pests and diseases are influenced considerably by the meteorological factors like temperature, rainfall, humidity, hours of sunshine and wind velocity.

What is now required is an organisation to assess the nature of relationship existing between the meteorological factors and the incidence of pests and diseases on cultivated crops. The Indian deputationists to Japan have stated in their reports that even in such a small country as Japan, there are as many as 276 Agricultural Meteorological observatories. In Japan every Agricultural Farm has a separate staff of at least three Assistants, solely meant for collecting data on the influence of the meteorological factors on the incidence of major pests and diseases on paddy, which is the main crop cultivated throughout the length and breadth of that country. Since data have been collected for nearly three-and-a half decades, Japan is able to give timely warnings to the paddy growers regarding the onset of epidemics of 'Blast' and Stem-Borer', from a knowledge of the existing weather conditions. By getting this advance warning, the farmers are able to take appropriate measures and spray the crop. Such a state of protection to crops and

reduction of their damage by pests and diseases should also exist in every State in India, particularly in Madras State, where the loss to crops due to pests and diseases assumes an alarming proportion in years of adverse weather conditions.

Loss due to weather abnormalities like cyclones, hailstorms, heat weaves, frost formation, etc., is not rare in cultivated crops. The coastal areas get periodically cyclonic storms, that cause considerable damage not only to cultivated crops like paddy, cholam, cotton, sugarcane, banana, etc., but also to perennial plantations like coconuts, mangoes, arecanut, etc. During hot summers heat waves and hailstorms are quite common. These weather abnormalities are capable of doing great damage to standing crops. In cold countries frost formation is practically an annual affair and particularly, the wheat growers of the Punjab know what an amount of havoc frost is capable of doing to their main crop of wheat.

It is possible to forecast the occurrence of these weather abnormalities if a network of observatories is maintained in particular localities. To cite a few instances, the observatories at Bombay and Poona were able to give timely warning of the cyclonic storm that struck the Bombay coast in November 1948. By this warning hundreds of lives of fisherman were saved. In addition, the agriculturists in the region had advance intimation of the approaching storm and they too were able to protect their crops to the extent possible. Another instance also may be cited. There is one instrument called 'Grass Minimum Thermometer', used for recording temperature of the air layer in contact with the surface soil. In the Punjab, if the difference between the readings recorded with this instrument on two consecutive days happens to be in the region of 30° to 35° F., immediately the wheat growers are given a warning of frost formation. Then the farmers will take necessary precautions to protect their crops. Even though the harvest of the wheat crop is to be taken up a week later they would immediately take it up on receipt of frost warnings, to get something as yield instead of allowing their entire crop to be completely damaged by frost. Examples like this may be piled up. But one thing is clear, i. e., that it is possible to predict these weather abnormalities, provided an efficient organisation is set up in this direction, in close collaboration with the Indian Meteorological Department. In America there are separate organisations to give warnings for every weather abnormality, including

floods and droughts. Similar organisations should be set up in every State in India also, if the interests of the agriculturists are to be protected properly,

It is thus possible to minimise the damage to crops by timely warnings of the incidence of pests and diseases and onset of weather abnormalities. Further, by enabling the farmers to have some rain at critical growth-phases of their crops, the yields of crops can be appreciably increased. The initial approach to these aspects will be on the sole responsibility of the Government. Based on the experience gained, enlarging the method of approach to give benefit to every cultivator depends on the co-operation from the public. It appears that in Great Britain there are about 4,000 observatories, solely managed by the public. In America the various weather services are mainly run by the public. If the public in India also realise their responsibility and come forward to help the Government, much progress can be expected. Collection of data and dissemination of the various warnings are to be entirely managed by the public, with the technical guidance and help of the Government. In case stimulation of clouds is proved to be a practical proposition every cultivator with an annual income of Rs. 5,000/- and above should come forward to have his own equipment to produce artificial rain. Cultivators with smaller incomes should join together and try to possess such on a Co-operative basis.

Acknowledgment: The author is extremely thankful to Sri. P. A. Venkateswara Iyer, Agronomist and Professor of Agriculture, for his valuable guidance in the preparation of this paper.

What Next in Agricultural Extension

by N. RANGANATHACHARI,
Agricultural College, Coimbatore

Introduction: The Agricultural department has been ceaselessly putting forth its efforts on the research and extension sides to better the lot of agriculturists who form the backbone of India's economy. Beginning with a handful of staff early in the century for the work of surveying the local agricultural practices and chalking out improvements, the department has gained much importance especially during the Second World War and shouldered the responsibilities of meeting the demands of farmers during the operation of the "Grow More Food" Schemes in respect of improved seeds, chemical fertilizers, iron and steel for fabricating agricultural tools and implements and supply of engines and pumps for irrigation purposes. The darkest days of food shortage have been tackled and now, though the food problem has considerably improved, the efforts of the department have not slackened and a closer network of field staff has been organised during this year.

In this paper, it is proposed to deal with the achievements so far gained, the needs of the farming population, and the future lines of work to be followed towards their economic uplift.

Recent achievements of the agricultural department in extension work: The residuary Madras State has 62% of its population engaged in farming. The agricultural policy and achievements in recent years are briefly as follows:—

Grow More Food Campaign and Five Year Plan. The G. M. F. Campaign was in operation from 1942 to 1949-50. The department distributed seeds of improved crop strains, manures and fertilizers, iron and steel for implements etc. at controlled rates, when due to inflation of prices they went beyond the purchasing capacity of the farmer and mostly disappeared from the open market.

In the meantime the Five-year Plan was launched from 1951 to 1955, with provision for 9 crores under agricultural improvements and 31 crores under irrigation schemes. The irrigation schemes included 'short-term' programmes of tank restoration,

'medium-term' projects like Malampuzha, Manimuthar and Amaravathi and the 'long-term' programme of Lower Bhavani calculated to benefit 3,83,000 acres on the whole.

Well-subsidy scheme: As a direct help to agriculturists, advances were given up to 50% of the cost of sinking a well and a farmer could receive the help to a limit of five wells. This was in operation from 1944 to 1951-52.

Filter-point tube-well scheme: The latest irrigation aid advocated since 1951, is the 'Filter-point tube-well' Scheme. This is designed to help the delta regions to grow a remunerative crop of groundnut or cotton in the fallow period, besides the paddy crop raised in the normal season. In addition, the paddy nurseries can be grown in advance of the receipt of channel water to enable early planting and getting higher yields. 1,060 filter points have been installed till 1954 and 600 more are expected to be completed during 1955.

Manures and Fertilizers: (a) *Green Manures:* The campaign on green manures and trial of different types like daincha, sunnhemp, wild indigo, pillipesara and *Sesbania speciosa*, for the wetlands resulted in recommending the cosmopolitan variety viz., *Sesbania speciosa*. This is very easy and cheap to grow, stands water-logging, yields seeds while growing along the bunds with the paddy crop and is the heaviest yielder of leaf per acre.

Among other leaf-yielding shrubs, *Gliricidia maculata* is the best, though *Indigofera teysmanni* is better suited for the West Coast.

(b) *Composts:* The municipalities are increasingly taking to production of nightsoil compost, as it is very remunerative. The individual farmers have also become compost-minded; they prepare composts in their own holdings and buy large quantities from municipalities also.

(c) *Chemical fertilisers:* The drive for increased production has made farmers go in for chemical fertilisers like ammonium sulphate and fertiliser mixtures. The annual sales in the residuary Madras State through the Agricultural Department is about 50,000 tons.

(d) *Oil-cakes:* Since a decade groundnut cake is so very extensively used as manure that cattle could not be fed with this cake in sufficient quantity. Out of a total production of three lakhs of tons, nearly two lakhs are applied to the land.

(e) *Other organic manures:* (i) Cattle dung — Only 50% of the estimated production of 20 million tons of cattle dung in the composite State is applied to the land and the rest is used partly as fuel and partly not collected at all.

(ii) Bones of Cattle: 1·5 lakhs of bones are estimated annually in the composite State; out of this, nearly 20% is collected, powdered and used as manure. The rest is going to waste.

Improved Seeds: As improved seeds contribute to nearly 15% increase in yields of food crops, seed farms are being run in the State for paddy and millets, seeds procured and distributed to a tune of nearly 4,000 tons of seed paddy and 38 tons of millet seeds in 1953–54 (residuary Madras State). A quick method of multiplying and distributing departmental strains of paddy seeds has recently been launched in the State known as 'Village Seed farm' Scheme. Village Agricultural Associations are formed, a few reliable farmers are selected from them and better strains of seeds are distributed to them at the rate of one pound for every acre under the crop in the village. An undertaking is given by the ryots who receive the pure seeds from the department that they would distribute the multiplied seeds to other farmers of the village in exchange for their local seeds raised by them. This system obliges the department to supply seeds only for the village seed farm areas and not to the entire village population.

Mechanised Cultivation: Farmers take recourse to mechanised farming to reclaim new areas and to carry out timely operations over extensive areas. To assist them in this direction, the department owns 159 tractors, of which 85 are fitted with bulldozer attachment and hires them out to farmers on request.

In respect of irrigation aids to replace human and animal power, oil engines and electric motors are being increasingly put to use. Here also the department comes to their help by offering on hire 1,726 oil engines and 411 electric motors which can command an area of 16,600 acres.

Agricultural Loans: Loans were advanced to farmers by the Revenue, Co-operative, and agricultural department for specific purposes, to the extent indicated below, in 1953–54.

Co-operative department	...	422 lakhs
Revenue department	...	18 lakhs
Agricultural department	...	14·28 lakhs

For the year 1954–55 provision was made for the agricultural department for disbursement of loans up to 70 lakhs for manures, 5 lakhs for tractor purchase, and 14 lakhs for pumping equipment.

VI. **Soil Conservation:** The Soil Conservation Board was constituted in 1951. It is tackling soil erosion problems in the Nilgiris and Malabar districts and portions of Coimbatore district. In Ketti valley (in the Nilgiris) 300 acres have been taken on hand under Soil Conservation programme.

Loans are also disbursed at Rs. 300/- per acre up to a maximum of Rs. 1,500/- per individual for carrying out Soil Conservation works.

As a famine relief work 5,752 acres have been contour-bunded in Coimbatore district.

Plant Protection: The plant protection work of the department was initiated in 1949. The chemicals used viz., B.H.C., D.D.T. and fungicides are sold at 50% of the cost price in areas declared as pest-infected for application to food grains, vegetables, chillies and betelvine. The area covered by the plant protection staff was 2·9 lakhs of acres in 1951–52 and expanded to 9·4 lakhs of acres, saving 48,000 tons of food grains valued at 1·3 crores of rupees.

The quantity of the various chemicals used by farmers increased from 500 tons in 1951–52 to 3,117 tons in 1953–54.

The increase in the yield of rice as a result of executing various schemes by the agricultural department amounted to 2,31420 tons in in 1953–54, by adopting the following improvements:

Ammonium sulphate & Superphosphate application	...	1,37,476 tons
Green manures	...	80,818 ,,
Improved seeds	...	6,455 ,,
Use of Tractors & Bull dozers	...	3,455 ,,
Filter point tube wells	...	2,915 ,,
Oil Engines and Electric motors	...	318 ,,
	Total	2,31,420 tons

The requirements: After listing out the achievements by the department, we may now indicate the requirements by farmers.

The present policy of an all-out aid deserves to be continued in respect of distribution of pure seeds, manures, filter-point scheme, hiring out tractors and pumpsets, plant protection, regulated markets for commercial crops etc.

The most essential need of the hour besides the availability of the facilities enumerated above is easy credit for several items of farming. Loans are already being granted by different departments but it takes time for disbursement. An additional facility would be the institution of an organisation which can advance loans on pledging produce, exchange pure seeds for local seeds, distribute the agricultural needs of the farmer in the v)llage. This will totally rid the cultivators of the necessity of obtaining credit at very high rates of interest ranging from 12% to 36% and playing into the clutches of merciless money lenders who are now standing in the way of the economic advancement of farmers.

Future Line of Work in Agricultural Extension: 1. The items of extension work now pursued must be organised as a network covering a wider area, enabling them to be within the easy reach of agriculturists from their villages.

2. The needs of the farmer have to be met by a multi-purpose device set up in each village to distribute finance for timely field operations, seeds, manures etc. for cash or in exchange for his commodities and also arrange to stock the produce and dispose it off when prices are favourable. The organisation is to be entirely managed by village leaders under the guidance of the Government; the initial financial outlay being advanced by the Government for equipping the Society with godowns etc., on long-term repayment basis.

3. The agricultural department on receipt of indents to will supply the godowns with stocks of seeds, manures, agricultural machinery etc. and transport them through mobile units to the village godowns on 'no loss, no profit' basis.

4. In projects like distribution of manures, plant protection, chemicals and equipment, essential farm implements and pumping units, the Government can enlist the co-operation of approved dealers in the above articles in stocking, carrying on propaganda and sales by sharing the cost involved in running the scheme i. e. cost of stocking, staff engaged in distribution etc.

At present each organisation is establishing a separate unit for the same item of work. By pooling the different organisations and sharing equally the cost of running the project, better work can be executed at lesser cost. Pooling comes in only at the ex-production stage.

5. Reviving the mobile vans with agricultural exhibits and running exhibition trains will greatly assist in impressing the population with agricultural progress.

6. Intensifying the community projects work and setting up a permanent exhibition of agricultural improvements in important towns and villages.

7. Running State farms or colonising new stretches of reclaimed land on Gezira model, which is briefly as follows:

The Gezira Scheme of Anglo-Egyption Sudan, functioning on the triangle of land lying between the Blue and the White Nile over 5 million acres is a thought-provoking experiment representing a compromise between nationalisation of land and communal farming and individual ownership by small peasant proprietors. It is nationalisation diluted by being subject to a fixed period. There is a tinge of socialism in that land improvement necessary in individual cases is carried out at the cost of all, but not socialised to the extent of pooling the profits.

The financial burden is borne by the Government and two private companies. The Government is responsible for provision of land, construction, maintenance and operation of the dam, maintenance of main canals and payment of rent for the land. The companies maintain the subsidiary canals, supervise cultivation, collect and store cotton crop, advance loans to tenants, work the ginning factories and market the crop. The tenants grow the crop under supervision by providing labour (water and land are free for cotton as well as other food and fodder crops) for which loans are given on easy terms.

The profits are shared as follows:

Government 40%, Companies 20% and Tenants 40%.

Extensive lands now lying fallow and which are contemplated to be brought under cultivation as in Athur of Salem district deserve a trial on the above lines.

Summary: The subject is dealt with under three main heads viz.. what has been done so far with the resultant achievements, what is the need for the hour and how best requirements can be met for the benefit of the farmers. The achievements in Grow More Food Scheme, manure distribution, irrigation facilities, seed supply, mechanised cultivation agricultural loans, soil conservation and plant protection are described. Among the needs of the farmers easy credit for cultivation, storing and marketing facilities are stressed. As a future line of work, intensification of extension branch, institution of an agency for not only meeting the financial needs of the farmer but for stocking produce, advancing loans on pledged commodities, supply of agricultural needs and marketing is mentioned. A fruitful way of enlisting the co-operation of trade in items that are common to both, utilising vast areas of newly reclaimed land on the model of Gezira is suggested.

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What Next in Agricultural Extension

by M. J. DAVID,
District Agricultural
Officer, Pattukottai

We have been doing extension work for more than half a century and in the recent past have covered lakhs of acres with improved seeds and green manures through village seed farm schemes. It is no exageration to say that *Sesbania* has become a household word and that there does not exist a single ryot who does not know *Sesbania.* Each village has got a village Agricultural Association and each taluk a Taluk Agricultural Association functioning, apart from the Divisional Ryots' Association. These associations keeps constantly in touch with the department and play a great part in extension work. These associations print a large number of leaflets detailing the remedial and preventive measures to be undertaken against pests and diseases and distribute them to the public. They give wide publicity about the Village Seed-Farms, green manures, pests and diseases, crop competitions, about cotton in rice fallows, and modified Japanese method, by putting slides in the local theatres at the appropriate times and thereby inducing people to step up production.

The members of these associations can be made to be of greater service to their fellow agriculturists by arranging inter-district exchange of farmers. The ryots of one division may not appreciate the value of cash crops like cotton, turmeric etc., but they can be easily convinced by taking them to other districts where they can see for themselves the growing of these cash crops. For instance, if the members of the Nagapattinam Taluk Agricultural Association are taken to a place like Coimbatore and shown the cotton crop or taken to Karur and shown a turmeric crop and explained the several advantages of growing such cash crops, the ryots will get impressed and in the next season they will be tempted to grow such crops. Likewise, if the Coimbatore or Karur ryots are taken to Nagapattinam and shown the three-mile belt of *Sesbania*, they will get impressed and will be tempted to grow the same in the next season. Without actually seeing the crops, the Agricultural Demonstrator explaining things will not bring very good results. For this purpose the State should undertake the responsibility of running extension specials and a fleet of extension buses equipped with loud speakers and other conveniences and manned by efficient and experienced extension publicity officers should be built up like a tourist service.

In the second five-year plan, there appears to be a proposal to cater to the needs of ryots in the matter of improved seeds by running

25 acre-blocks of seed farms. These seed farms can function effectively only if the seeds produced are exchanged against ryots' grain. Without sufficient drive the entire quantity of seeds produced would not be distributed and all the villages would not be covered. By having qualified officers in large numbers, large areas of seed farms can be supervised more critically. We can appeal to the trustees of temples and other religious institutions to give us some of the lands for starting these seed farms, and the money so saved can be made use of for paying the large number of officers appointed for running such seed farms. The seed produced at such farms can be exchanged for grain. The labourers of the farm may be paid half in kind and half in cash. The seed-farms can be maintained in such a way that they will attract the neighbouring farmers and other visitors who in turn will improve the standard of farming much to the prosperity of the nation as a whole. The produce of such seed farms can be distributed by taking them in lorries to the interior villages and exchanging the seed for the villager's grain.

So then the next step in extension work is greater participation of the farmers in the work of the Department by (1) exchanging the seeds produced in seed farms for their grain (2) by organising extension special trains and extension buses equipped with loud speakers and other conveniences in which members of village and taluk agricultural associations could be taken in hundreds to neighbouring districts by experienced officers and shown and explained the agricultural activities in well-run holdings, just as we take Agricultural College students. We must create in the minds of the mass of the ryots a feeling that we and they are joint partners in a great undertaking to double production and increase the standard of living of the mass of our people within the second five year plan period.

Weather Review — For April, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	0·3	— 0·7	3·1
	Tirurkuppam*	0·4	— 2·4	3·0
	Vellore	4 6	+ 2·3	5·9
	Gudiyatham*	3·4	+ 0·9	4·3
East Coast	Palur*	0·3	— 3·2	2·6
	Tindivanam*	1·1	— 0·8	3·8
	Cuddalore	0·3	— 0·7	2·3
	Nagapattinam	Tr.	— 1·6	3·0
	Aduthurai*	0·5	— 2·1	3·5
	Pattukottai*	0·4	— 1·0	3·0
Central	Salem	1·3	— 3·3	2·3
	Coimbatore (A. M. O.)*	0·2	— 2·1	1·9
	Coimbatore	0·1	— 2·4	1·8
	Tiruchirapalli	1·4	— 1·2	3·1

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
South	Madurai	0·3	— 2·4	2·7
	Pamban	Nil	— 1·0	1·2
	Koilpatti*	1·1	— 1·8	4·2
	Palayamcottai	1.4	— 1·2	3·9
	Ambasamudram*	0·7	— 0·8	5·3
West Coast	Trivandrum*	4·7	— 4·1	11·7
	Fort Cochin	25·1	+13·4	41·9
	Pattambi*	12·0	+ 4·7	17·6
	Kozhikode	19·2	+10 3	28·1
	Taliparamba*	19·4	+11·0	22·6
	Wynaad*	4·2	— 2·6	11·4
	Nileshwar*	28·2	+19·7	33·0
	Pilicode*	17·3	+ 8·7	23·3
	Mangalore	26·7	+19·0	28·4
	Kankanady*	27·2	+20·8	28·8
	Kotekar*	23·8	+17·3	£
Hills	Kodaikanal	3·2	— 3·2	12·8
	Coonoor*	1·3	— 2·5	8·0
	Ootacamund*	3·3	— 3·4	8·9
	Nanjanad*	1·7	— 3·7	5·4

Note :— 1. * Meteorological Stations of the Madras Agric. Dept.
2. Tr. — Trace (Rainfall 0·01″ to 0·04″).
3. £ = It is a new station. Raingauge was installed only in March 1956.

The depression on 30—4—1956 near Gadag moved westwards on 1—5—1956 and emerged into the East Central Arabian Sea. Under its influence Travancore-Cochin and Malabar and South Kanara had widespread rains. Showers in these regions became scattered on the next day. The weather for six days from 3—5—1956 was mainly dry except for isolated showers in interior Tamilnad on 6—5—1956, scattered showers in Travancore Cochin and north Tamilnad on 7—5—56 and localised showers in Travancore-Cochin on 8—5—56. On 9—5—1956 a few places in interior Tamilnad had some mild showers. This sort of weather continued till 13—5—1956. A feeble trough of low developed off the Malabar Coast on 14—5—56, but the weather was dry on this day. A temporary advance of the monsoon took place on 15—5—1956 and Malabar and South Kanara had widespread rains. On 16—5—1956 the same weather prevailed in the West Coast, though in other places, except a few in interior Tamilnad, it was mainly dry. Malabar and South Kanara and a few places in northern Tamilnad had localised showers on 17—5—1956. Again the monsoon showed a temporary advance on 18—5—1956. From this day upto 27—5—1956 rainfall was fairly widespread in Travancore-Cochin and Malabar and South Kanara and scattered and localised in a few places in Tamilnad. In the last four days of the month the west-coast had fairly widespread rains and the weather in Tamilnad was mainly dry.

Considering the month as a whole the districts constituting the East Coast, Central and Southern portion of the Madras State had only sub-normal rains. The districts of Chingleput and North Arcot and those in the West Coast had fairly good rains. The Nilgiris district and the Kodaikanal area of the Mathurai district had poor rains. Anyway the severity of summer was not actually felt anywhere in the State.

The noteworthy rainfall and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Depar-ture from normal	Remarks
20/5/56	Trivandrum	2·0	North	2·2	J. N.	Just normal
22/5/56	Alleppey	3·0	East Coast	0·4	— 1·6	Far below normal
23/5/56	Cochin	4·0	Central	0·8	— 2·3	do
do	Kozhikode	2·0	South	0·5	— 1·4	do
24/5/56 & 26/5/56	Mangalore (Each day)	4·0	West Coast	18·9	+ 10·7	Far above normal
			Hills	2·4	— 3·2	Below normal

Note :— J. N. — Just normal. Actual figure is +0.025".

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 11—6—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Transfers

Name and present post	Posted as
Kandaswami M., Govt. Mycologist, Coimbatore.	Crop and P. P. O. Mycology, Coimbatore.
Mohamad Ali A. M., Asst. Agrl. Eng., Soil Conservation, Ootacamund.	Asst. Agrl. Eng., Paramakudi.
Ramakrishnan, Dr. K., Senior Lec., Madras University, Madras.	Govt. Mycologist, Coimbatore.
Ramasubba Iyer A. K., D. A. O. Sattur. (On leave)	Spl. D. A. O. Crop Sampling, Tanjore.
Seshadri A. R., Asst. Entomologist. (On leave)	Agriculturist, Coimbatore.
Shanmugam C. R., Trainee in Soil Conservation, Dehra Dun.	Asst. Agrl. Eng., Soil Conservation, Ootacamund.

STUDENTS' CLUB NEWS

The executive members and office-bearers of the Agricultural College Students' Club for the academic year 1956-'57 were elected at a General Body Meeting held on 9—5—1956 at 6 P. M. with Dr. A. Mariakulandai, the Vice-President, in the chair.

The members elected for different games and for other activities are given below:—

Sri D. Paulas of Class III	..	Club Secretary.
,, P. M. Krishnamurthy of Class III	...	Games Secretary.
,, T. N. Sivasankaran of Class II	...	Cricket Captain.
,, V. Mariappan of Class II	...	Tennis Captain.
,, G. C. Perumal of Class II	...	Hockey Captain.
,, M. Sunchiah of Class II	...	Football Captain.
,, N. P. K. Shahul Hameed of Class II	...	Minor games Captain.
,, V. Rajaguru of Class III	...	Class Representative.
,, K. Kothandaram of Class II	...	Class Representative.

The following were elected as office-bearers outside the Executive Committee for 1956-'57.

Sri G. Ramanathan	...	"The Tatler" Editor.
,, S. Sundaram	...	Secretary, Debating Society.
,, M. Thangavelu	...	,, Dramatic Society.
,, T. S. Govindarajan	...	,, Social Service league.
,, A. Chidambaranathan	...	,, Photographic Society.
,, K. Karuppuswamy	...	,, Hiking Society
Kumari R. Sivagami	...	Lady Students' Representative.

This newly-formed Committee stood welcome tea on 4—6—1956 to Dr. K. C. Naik, the new President of the Club. The Budget for 1956-'57 was provisionally discussed before placing it before the General Body Meeting.

G. RAMANATHAN.

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Editorial

Our readers would no doubt have seen the announcement in the June issue of this journal, of the subject for the symposium on "Modern trends in Indian Agriculture" proposed for the next College Day and Conference in August 1956. In a fast-changing world, agriculture is no exception and even in the so-called "unchanging orient", great changes are taking place in many aspects of agriculture. Every war causes a major upheaval, not only in frontiers and populations, but in outlook and ideas as well and the last World War II has left in its wake far-reaching effects on agriculture and crop production.

Perhaps the most important of these, is the realisation of a one-world concept as exemplified in the F. A. O. in the field of agriculture. The next in importance is, at least in India, the conception of a Welfare State, where it is taken as the primary duty of the State to take all steps to ensure an adequate level of nutrition and well-being for all the inhabitants in the State. Arising out of this concept we have in India numerous hydro-electric schemes, designed to improve crop production by ensuring an adequate supply of irrigation water, together with ancillary amenities provided by electricity for all the varied requirements of an agricultural holding. The provision of adequate fertilisers too, is now recognised as one of the primary duties of the State, as exemplified by the factories at Sindri and T. C. State.

When we talk of increased production, our aim is obviously not maximum yields at any price, but only maximum yields for the minimum possible expenditure of labour and money, with risks eliminated and all preventible wastes safeguarded, that are caused by pests, diseases and weed competition.

In agriculture proper, some of the major trends that are evident in modern times may perhaps be just mentioned. Beginning with the soil, a good lot of the old-time concepts regarding deep ploughing, tilth, mulching and the merits of "clean cultivation" have gone overboard and in their place the paramount importance of preventing soil erosion by suitable cultural and conservation methods is now widely recognised. From the fertiliser angle, we are now beginning to realise the importance of balanced manuring in maximising production, with adequate supplies of both major and minor elements in available forms. Refinements in analytical techniques with the aid of radioactive isotopes, timely recognition of nutrient requirements by means of visual symptoms, rapid soil and tissue tests and their rectification by the use of foliar sprays and other methods, these are proving now of very great help in agriculture. A whole range of new chemicals, known as growth-regulating compounds, have opened up immense possibilities in crop production by way of selective weed control, prevention of fruit-shedding, induction of earlier flower or fruit production, better ripening, control of dormancy in tubers etc., and as a further extension of this, we have also recognised the great possibilities that lie in the use of antibiotics, both in reducing losses by diseases and improving crop production. Great developments have also taken place in the use of new chemicals that are very effective as fungicides and pesticides and further studies are in progress all over the world to perfect effective systemic fungicides and pesticides. On the plant breeding side we are now in a position to synthesise new varieties and strains by means of chemicals like colchicine, and interspecific hybridisation. And so the search goes on, as a never-ending quest for increasing production, to feed, clothe and keep in normal health the ever-increasing population of the world.

A Note on the Sowing of Kolinji in a Standing Crop of Paddy on the West Coast.

by

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Introduction: The value of green manuring paddylands has been well recognized. The practice of actually growing a green manure crop in the fields, has also become widespread. The success of raising a green manure crop in rice lands depends upon the type of land, whether it is single or double crop land, the nature of the soil etc., but the availability of moisture is a limiting factor in almost åll cases. In Malabar, *Kolinji* is one of the most popular of all the green manures and is generally sown in double-crop lands, after the harvest of second crop paddy. In the past few years, due to the successive failures of the North-East monsoon, the sowing of this green manure after second crop harvest was very much limited for want of moisture in the fields.

The seeds of *kolinji* are very poor germinators when sown as such. Several methods have been tried in the past to overcome this difficulty and among these, scarification or rubbing down the seed-coat was found to be a very easy and effective method. In order to effect scarification on a bulk scale, the ryots pound the seeds of *kolinji* mixed with sand before sowing. From a practical point of view, it will be advantageous if the seed sown directly without any pretreatment could give as good germination and yield as pre-treated seeds.

Data relating to trial of sowing of *kolinji* seeds in a standing crop of paddy, with dressed and undressed seeds conducted at the Agricultural Research Station, Pattambi are presented in this paper.

Previous Work: Sowing of green manure seeds in a standing main crop before it is harvested is reported to be in vogue in many places. In the Godavari delta a crop of sunhemp is usually sown under the rice before it is harvested. (Ramiah, 1937). In America, there exists the practice of seeding clovers on winter cereals or with spring grain and the clover is said to occupy the ground after the grain has been harvested (Pieters 1927). For improving germination in *kolinji* seed Chandrasekara Iyer (1944) recommended sand - papering.

Experimental: Broadcast sowing of *kolinji* seeds, both dressed and undressed (dressing being done by pounding with an equal quantity of sand for 15 minutes) was done in a standing crop of GEB. 24 at fortnightly intervals commencing from the date of its planting upto the date of harvest. Control included ploughing and sowing of both dressed and undressed seeds after the harvest of paddy. As long as there was water available the flow was regulated to allow about two inches of water to stand in the field. The paddy crop was harvested and the green manure crop was left to grow till the next first-crop planting, when it was pulled out after taking counts per unit area and estimating the acre yields. In the second year of trial the control could not be sown as ploughing could not be taken up after harvest for want of sufficient moisture. The yield data are presented in the table. The cost of sowing one acre with dressed *kolinji* seeds after the harvest of paddy was also worked out and found to be Rs. 7—8—0 per acre.

From the results it will be seen that maximum yields in both the years of trial were recorded if the seeds were sown when the field was just slushy. Seeds sown in plots where water was stagnating for a long period gave very poor germination and poor yields. This is but to be expected, since the majority of seeds are liable to rot when steeped in water for a long time. Counts of number of plants per unit area taken in order to assess the comparative germination of dressed and undressed seeds showed little or no difference when sown in the standing crop, whereas in the control plot there was a marked difference in the germination between the two. It is likely that under continuously moist conditions existing in the slushy field, even hard seeds may germinate. The fact that hard seeds of *Alfalfa* germinate when kept in moist condition for several months supports this. Sowing the seeds in the standing crop also brings about an economic gain, by way of saving the preparatory cultivation for raising the green manure.

Summary: 1. Kolinji seeds sown in the standing crop of paddy when the field is just slushy, is found to record the maximum yield of green matter.

2. When sown in the standing crop, sowing of undressed seeds is found to be as good as sowing dressed seeds both in yield and germination.

3. By sowing *kolinji* in the standing crop of paddy the ryot stands to save about Rs. 7-8-0 per acre in the preparatory cultivation alone.

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TABLE

Years of trial	Fortnight	Date of sowing of Kolinji	Acre yield in lbs. of *Kolinji* dressed	Acre yield in lbs. of *Kolinji* not dressed	Nature of moisture in the field
1951—52 Paddy GEB. 24	I	27—10—'51	6 lb.	95 lb.	Water stagnating over 45 days.
Sown: 21-9-'51	II	15—11—'51	219 ,,	63 ,,	do
Planted: 26 & 27-10-'51	III	30—11—'51	92 ,,	42 ,,	Water stagnating over 30 days.
Flowered: 4-12-'51					
Harvested: 17-1-'52	IV	14—12—'51	152 ,,	200 ,,	do
	V	29—12—'51	139 ,,	475 ,,	Water stagnating over 15 days.
	VI	13—1—'52	4500 ,,	4450 ,,	Field slushy without stagnating water.
	Control	19—1—'54	3200 ,,	1700 ,,	Moisture just sufficient for germination.
1952—53 Paddy GEB. 24	I	10—10—'52	8470 ,,	8200 ,,	Field slushy.
Sown: 27-8-'52	II	25—10—'52	7260 ,,	7400 ,,	Moisture sufficient for germination.
Planted: 8-10-'52					
Flowered: 27-11-'52					
Harvested: 4-1-'53	III	9—11—'52	3932 ,,	3860 ,,	Field just moist.
	IV	24—11—'52	756 ,,	200 ,,	Field started cracking.
	V	9—12—'52	756 ,,	620 ,,	Cracking continues.
	VI	24—12—'52	Not germinated		No moisture.

Control could not be sown for want of moisture.

Chilli Wilt and its Control

by

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Chillies are cultivated in almost every district of this State over an extent of 1,25,180 acres and this forms one of the important money crops to the ryots. This crop is affected by a number of fungal diseases, among which the fruit rot and die-back caused by *Colletotrichum capsici* and the fruit rot caused by *Alternaria solani* were considered to be the most important ones. However in recent years a wilt disease caused by *Sclerotium rolfsii* is gaining importance in this State, especially in Udumalpet and Pollachi taluks. The disease appears all of a sudden under favourable conditions and spreads very rapidly.

Symptoms of the Disease: The initial symptom of the disease is the drooping of leaves in a few branches. The drooping may spread rapidly to other branches also, depending upon the humidity and soil moisture. When the wilted plants are pulled out whitish, thread-like, cottony growths can be seen at the collar region. Sections of the infected portions reveal that the fungus can invade deep into the tissues also. The bark at the infected portion rots and the fungus penetrates into the wood and causes wilting. The fungus is also capable of infecting the fallen leaves and fruits of chillies. Later on, the fungus produces the sclerotial stage, which can be easily identified by the presence of greyish, mustard-like spherical bodies (Sclerotia). These sclerotia are able to remain viable for long periods and are not affected by adverse climatic conditions. Therefore control measures should be started long before the formation of sclerotia to keep off the disease from the field. It was also observed that the spread of the fungus on the stem is limited to the extent to which the soil is earthed up round the stem. In severely affected fields the mortality range of the plants goes up to 60% when left unchecked. In order to evolve suitable control measures for the disease, field experiments were laid out in a private holding at Erisinampatty (Udumalpet taluk) and the results are given in the following paragraphs.

Materials and Methods: The control methods mainly consisted of soil applications of various fungicides, to kill the fungus as well as avoid conditions favouring the spread of the disease. Nine

treatments (vide table 1) were tested in randomised and replicated plots. Each plot included 45 plants and measured one cent in area. Before drenching the soil, the earth around each plant was removed and a small basin was made, to hold the fungicides used for drenching. Completely wilted plants were carefully removed and destroyed and the soil around the uprooted plants also was drenched with the fungicides. Irrigation was stopped for four days after giving the treatments. The treatments were given thrice, at an interval of one week between the first and second and two weeks between the second and third treatments. Observations were made before giving the treatments each time and the condition of the plants were recorded as healthy, partially wilted and completely wilted plants.

Experimental Results: The first round of treatments was given on 29–10–1955 when the plants were about four months old, after recording necessary observations; the second and third rounds of treatments were given on 7–11–1955 and 23–11–1955 respectively. The results of the observations made are furnished in the table below:

TABLE I

Treatments	Strength used	No. of wilted plants at the time of starting the experiment	No. of apparently healthy plants at the time of starting the expt.	No. of further wilted plants	Mean percentage of wilt after treatment
Orthocide	1 lb in 50 galls.	19	161	10	6·13
Bordeaux mixture	1%	11	169	2	1·21
Cheshunt compound	1 oz. in 2 galls.	22	158	4	2·51
Leytosol	0·1%	29	151	7	4·86
Leytosol	0·5%	24	156	0	—
Ceresan (wet)	0·1%	23	157	1	0·66
1-Hydroxy - 2 (H) Pyridinethione Na salt	1 gm. in 2½ galls.	19	161	11	7·22
Removal of earth		21	159	6	3·69
Control		18	162	10	6·19

It is seen from the table that drenching the soil with 'Leytosol' 0·5% is the most efficient method of checking the disease and this is followed by Ceresan wet 0·1%, Bordeaux mixture 1% and Cheshunt compound, in order of merit, the other treatments being inferior to these.

Cost of Treatment: The chemicals were drenched at the rate of 250 gallons per acre. The costs of fungicides used for one drenching are given below, the cost of labour for drenching works out to Rs. 1—4—0 and this being the same for all the treatments except the control, the cost of the chemicals alone has been taken into consideration.

TABLE II

Fungicides	Quantity required per acre per treatment	Cost per pound	Total cost of chemical required per acre
Orthocide ..	5 lb. 4 oz.	Free supply	Price not known
Bordeaux Mixture ..	Copper sulphate 25 lb.	0 12 0	19 8 6
	Lime 25 lb.	0 0 6	
Cheshunt Compound ..	Copper sulphate 1 lb. 4 oz.	0 12 0	3 9 0
	Ammonium carbonate 7 lb.	0 6 0	
Leytosol 0·1% ..	2 lb 8 oz.	Free supply	Price not known
Leytosol 0·5% ..	12 lb. 8 oz.	- do -	- do -
Ceresan wet 0·1% ..	2 lb. 8 oz.	4 13 3	11 0 6
1 Hydroxy 2 (H) Pyridinethione - Na salt ..	100 grams.	Free supply	Price not known

Conclusion: Leytosol 0·5%, Ceresan wet 0.1%, Bordeaux mixure 1%, and Cheshunt compound (1 oz. in 2 gallons of water) have effectively controlled the disease. Although Cheshunt compound is slightly less effective as compared to Leytosol 0·5% in controlling the disease, it is much cheaper in cost, besides being non-poisonous and it can also serve as a nitrogenous manure, as it contains nearly 85% of ammonium carbonate.

Crop Residues of Paddy and their Manurial Value

by

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Introduction: Information on the amount of organic residues left by a crop after harvest is not available for many crops of the State. This information is important, as crop residues contribute considerably to the soil organic matter content and also add nitrogen and other plant nutrients to the soil. The nitrogen in the organic matter is in the form of humus protein which is resistant to microbiological attack but ensures a steady stream of ammonia and nitrate during the growing season of a crop. The phosphorus compounds in humus are also available gradually by the decomposition of humus; this organic phosphorus is about as available to plants as inorganic phosphorus. Even in paddy, which is an important crop of the State, no reliable data are available anywhere in literature. Therefore, an attempt was made to gather this information on paddy, using CO.25 variety.

Material and Methods: In an experimental field, soon after the harvest of paddy, an unit area of one square yard was marked with ropes and the roots and stubbles in that area were dug out and collected along with the earth so as not be to lose the finer roots. The stubbles were washed thoroughly to remove the soil, dried in the sun and weighed. Samples were taken similarly from four other plots and finally subjected to analysis. The yield of grain and straw of the respective plots from which roots and stubbles were collected were also recorded. The plant materials were analysed for nitrogen, phosphoric acid and potash.

Results: The yield of grain and straw of the different plots with the estimated quantity of stubbles and roots left behind by a crop is given in Table I.

The proportion in which the different parts of the crops are obtained is given as percentages in Table II. The nitrogen, phosphoric and potash contents of grain, straw, stubbles and roots are given in Table III. The chemical composition of the various parts are given in Table IV. The quantity of plant nutrients removed by the crop from the soil, through grain and straw is given in Table V. The quantity of crop residue and their manurial values

in pounds per acre are given in Table VI. The quantity of nutrients removed by grain and straw and those left behind in stubbles and roots are given in Table VII.

Since green plants synthesise organic matter out of inorganic elements and simple compounds obtained partly from the atmosphere and partly from soil, they have a part in augmenting the organic matter content or humus of the soil. For it has been estimated that 85 – 99 percent of organic matter of plants is formed from the carbon dioxide of the air. Therefore, the crop residues such as roots and stubbles, help to increase the humus content of the soil. It is seen from the study that a paddy crop yielding about 4080 lb. of grain and 6880 lb. of straw per acre leaves about 2460 lb. of residues in the form of stubbles and roots. This works out to 35·81 percent on the straw yield or 24·55 percent on the total aerial portion harvested as grain and straw. If computed on the whole plant, inclusive of roots, the quantity of roots and stubbles comes to 18·37 percent or about a fifth of the total yield of grain and straw. The quantity of roots and stubbles is likely to vary according to the variety, seedrate used, distance between plants, manuring and other agronomic practices inclusive of the method of harvesting, which varies widely from place to place.

From the analytical data (Table II) it will be seen that there is a wide variation in the three major plant food elements namely, nitrogen, phosphoric acid and potash in the different parts of paddy plant. Highest amounts of nitrogen and phosphoric acid are found in the grain while potash is highest in the straw. The potash content of the grain is the lowest. The stubbles and roots contain the lowest amount of nitrogen while the phosphoric acid content is better than that of the straw. Potash content of stubbles and roots is fairly high.

The proportion of stubble to root was found to be 1 : 1·45. The composition of stubbles and roots are given in Table III. Stubbles contain more nitrogen, while roots cotain more of phosphoric acid and potash.

The amount of plant food elements removed by a crop from the soil depends upon the composition of the grain, straw, roots and stubbles. It is found in the present study that a crop of paddy giving 4080 lb. of grain and 6880 lb. of straw removes from the soil about 88 lb. of nitrogen, 43 lb. of phosphoric acid and 112 lb. of potash.

The quantity of these elements left behind in the crop residue is about 11 lb. of nitrogen, 15 lb. of phosphoric acid and 16 lb. of potash. The total organic carbon added to the soil is about 534 lb.

It has been the established that carbon : nitrogen ratio in humus is usually from 9 : 1 to 12 : 1. When straw containing a large amount of carbon and very little of nitrogen is incorporated into the soil, only a small part of the carbon is utilised by the soil microorganisms and the major portion of the carbon escapes as carbon dioxide. If an average carbon : nitrogen ratio of 10 : 1 is assumed, the amount of carbon of 534 lb. left in the crop residue would require 53·4 lb of nitrogen to form humus. The residue contains only about 9·7 lb. of nitrogen and therefore, about 45 lb. of nitrogen will have to supplemented. This amount of nitrogen is necessary, as the high amount of lignin, contained in these crop residues that are transformed into humus, require a greater quantity of nitrogen for a larger percentage of conversion of dry matter into humus. If the requisite quantity of nitrogen is not available there will be a partial nitrogen starvation owing to the activity of micro-organisms that will draw up the available nitrogen of the soil. Such a condition would lead to crop failure.

Instances of crop failures are not wanting and the failure of cotton following *Irungu* cholam in the Tirunelveli tract is a good example. The failure of cotton was attributed to several causes but finally the studies by Menon and Menon revealed that the reduction in yield of cotton (by about 16 percent) was caused by the poor nitrogen supply, as the available soil nitrogen was immobilised by the activity of the micro-organisms which acted upon the cholam stubbles left behind by the preceding crop. Supply of nitrogen can be effected by growing a leguminous green manure crop and turning it in in places where water is available. Otherwise nitrogen can be supplied though a nitrogenous fertiliser.

Conclusion: The study indicates that appreciable amounts of organic residues are left behind by a crop after harvest. Such residues are important from the point of building up soil humus for improving the fertility level of soils. In most places where there is no facility for raising green manures or where cattle manure supply is inadequate, the importance of crop residues cannot be over-estimated. But, for conversion of a larger portion of the organic residues into humus the nitrogen supply has to be augmented

and this can be effected by the addition of nitrogenous fertilisers such as ammonium sulphate, to facilitate decomposition of crop residues and their conversion into humus.

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TABLE I

The yield of paddy grain and straw obtained from an acre as well as the estimated quantity of stubbles and roots:

	In pounds 1	2	3	4	5	Average
Grain ..	4080	4260	3980	3780	4300	4080
Straw ...	6860	6960	6160	7340	7098	6884
Stubbles & Roots ..	2290	2470	2687	2178	2704	2466

TABLE II

Proportion of crop residue to other parts, as percentage:

	1	2	3	4	5	Average
Stubbles and roots to straw ..	33·38	35·49	43·61	29·67	38·10	35·81
Stubbles and roots to total aerial portion ...	20·93	22·01	26·49	19·58	23·72	24·55
Stubbles and roots to the whole plant ..	17·31	18·04	20·95	16·38	19·18	18·37

TABLE III

Composition of stubbles and roots:

	Proportion %	Nitrogen %	Phosphoric acid %	Potash %
Stubbles ..	41·2	0·403	0·172	0·777
Roots ..	58·8	0·373	0·199	0·991

TABLE IV

The chemical composition of grain, straw, roots and stubbles (Percent on dry basis):

Plant nutrients		1	2	3	4	5	Average
				Grain:			
Nitrogen	..	1·120	1·120	1.330	1·310	1·070	1·109
Phosphoric acid	..	0·736	0·724	0·747	0·793	0·718	0·744
Potash	..	0·720	0·770	0·680	0·680	0·710	0·712
				Straw:			
Nitrogen	..	0·630	0·639	0·600	0·511	0·525	0·581
Phosphoric acid	..	0·212	0·178	0·205	0·163	0·163	0·163
Potash	..	1·170	1·210	1·220	1·250	0·160	1·202
				Stubbles and roots:			
Nitrogen	..	0·400	0·390	0·440	0·380	0·390	0·394
Phosphoric acid	..	0·290	0·290	0·250	0·250	0·230	0·262
Potash	..	0·960	0·990	0·980	0·960	0·970	0·972

TABLE V

Plant food elements removed by the crop through grain and straw:

Element		1	2	3	4	5	Average
				Grain:			
Nitrogen	..	45·70	47·71	52·94	49·52	46·01	48·38
Phosphoric acid	..	30·04	30·84	29·73	29·98	30·87	30·29
Potash	..	29·38	32·80	27·07	25·71	30·54	29·10
				Straw:			
Nitrogen	..	43·21	44·47	36·97	37·51	37·27	39·89
Phosphoric acid	..	14·54	12·05	10·63	11·96	11·57	12·55
Potash	..	80·26	84·21	75·17	91·75	82·34	82·75

TABLE VI

Quantity of plant material left as crop residue and their manurial value in pounds per acre:

		1	2	3	4	5	Average
Stubbles and roots	..	1700	1799	2223	1788	1955	1893
Organic carbon	..	427·40	534·40	632·50	543·70	534·00	534·40
Nitrogen	..	9·20	9·60	11·80	8·30	9·70	9·72
Phosphoric acid	..	6·60	7·20	6·70	5·50	6·20	6·44
Potash	..	16·32	17·82	21·79	17·17	18·96	18·41

TABLE VII

Plant food elements removed by grain and straw and left as crop residue. Average Values:

Nutrient elements		Grain and Straw	Stubbles and roots	Percentage on grain and straw
Nitrogen	..	88·27	9·72	11·01
Phosphoric acid (P_2O_5)	..	42·84	6·44	15·03
Potash	..	111·85	18·41	16·45

Selected Article

Extension Training Programmes

by

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The backbone of the whole programme of intensive rural development envisaged under the First and Second Five Year Plans of the Government of India is the village worker. As the strategic and vital link between all the rest of the development programme organisation and the village people, he is the solid nucleus around which the whole extension programme is built. The task of training these village workers, which is vested in the Directors of Extension and Training, Ministry of Food and Agriculture, is, therefore, one of almost frightening responsibility—but also a stimulating challenge. For how well *Gram Sevaks* succeed in there careers depends to a marked extent upon the training which they have received.

The history of the training institutions working under the guidance of Directors of Extension and Training is well-known. It was in 1952 that five Extension Training Centres were established at Mandya (Mysore), Sindewahi (M. P.), Burdwan (W.B.), Bakshi-ka-talab (U. P.) and Anand (Bombay). In October of that year the Community Projects Programme envisaged the establishment of 1,200 blocks, which needed 12,000 trained extension workers at the village level, in addition to the various supervisory personnel at the block level. To meet this urgent need the Ministry of Food and Agriculture immediately took in hand the establishment of 29 more Extension Training Centres, in co-operation with the State Governments.

To-day, there are 43 Extension Training Centres in the country and 54 Basic Agricultural Schools for pre-extension training, where carefully selected young men are undergoing an exacting programme of training for the service of the rural people in all spheres, viz., Agriculture, Health, Education, Rural Industries, Co-operation, Rural Organisation etc.

In addition, a comprehensive programme of Home Science Extension Training has also been taken in hand. When the National Extension Service was inaugurated in the country on

October 2, 1953, there was no attempt at introducing a programme for women and girls in the villages. This was due to the fact that the obstacles in developing a Home Science Programme in India seemed to be formidable. Not only was there an acute lack of trained women workers for implementing this programme, but the conservative outlook of the people, the resistance to change in the social and cultural patterns of their lives, the difficulty of reaching the villages, the poverty and illiteracy of the village folk, and the difficulties experienced by women workers living and working in villages seemed to present insurmountable difficulties.

Nevertheless, it was soon realised that unless the women of the village were carried along, the whole Extension Programme was not likely to achieve any great success. During the year 1952–53, these vague feelings took a concrete shape. The Development Commissioners and Project Officers in the various States pointed out that their efforts at village improvement, such as bettering environmental hygiene, food, kitchen gardening, latrines, compost pits, etc., could not progress because women failed to understand the objectives. Thus a national programme for rural women in Home Science was found necessary and for training the *Gram Sevikas* for this purpose, a National Home Science Wing has been sanctioned to be established in the various States, each with one Chief Instructress and two Assistant Instructresses.

The demand for the Second Five Year Plan is for 58,000 *Gram Sevaks*. To fulfil this need, an additional 18 Extension Training Centres and 41 Basic Agricultural Schools will have to be established during the Second Five Year Plan period. The number of Home Science Wings will also have to be increased.

When Extension Training was originally started, there was a good deal of confusion about what "Extension" really meant. Even the administrators and the workers in the field were not quite clear about its conception and implications. In the populor imagination, "Agricultural Extension" simply meant the sale of seeds, fertilisers, pumps and ploughs, with lecturers and directives inculcating the use of improved practics. It was, therefore, assumed by many that there was nothing very new in "Extension" as work of this nature had been carried on in India for a number of years.

The conception of an all-round development of the community through activities carried on in various spheres such as Health,

Sanitation, Education, etc. in addition to Agriculture, through multi-purpose workers was still more difficult to appreciate.

The word "Extension" is used widely and rather loosely to-day to cover all types of social developmental work in the rural areas. But if the so-called "Extension", as it was practised in the past, was good enough for the re-orientation and development of the people, it is strange indeed, that the yields per acre had remained as low as they were and the progress of the people in the rural areas had been almost negligible.

It is essential, therefore, that we should appreciate the real meaning and conception of "Extension". "Extension" as a specialised system, was evolved in the United States of America, as early as 1912, as an out-of-school method of education for the people. That growing country, in her endeavour to come to the forefront as speedily as possible as one of the leading nations, realised that education for all must go hand in hand with increased income through efficient production, thus ensuring an improved standard of living.

How could this be achieved in the shortest possible time? Was it possible to establish schools for vacational training as well as for training in the humanities in every parish and village in the country? Even if that could be done, would those schools be able to handle the education of the adults and, last but not the least, would such class-room lecturers and routine institutional training succeed in imparting practical skills in the various occupations in the shortest possible time? The answer was in the negative in every case and the solution was to introduce a system of out-of-school education, where adults and youths would be enthused to learn by practising the improved skills in their own professions and motivated to endeavour for a better way of life in every respect through knowledge and work.

"Extension", therefore, is fundamentally a system of out-of-school education for adults and youths alike. It is a system, where people are motivated through a proper approach to help themselves by applying science in their daily lives, in farming, home-making and community living.

It is a system where the Extension teacher trains his pupil to be a teacher to teach without a school and, where the trained

pupil in turn motivates the village people to accept the improved practices for better living directly or through village leaders and local institutions. It is a system, where through personal contacts, meetings, method demonstrations, result demonstrations, audio-visual aids, etc., the people are educated and enthused even without regular class rooms and institutions regarding the adoption of improved scientific practices on their farms and in their homes. It is a constant process of education and, is fundamentally an educational method where education is imparted without school room lectures. The problems of various services for development or welfare is actually secondary, the fundamental point being how to approach people at all levels and standards correctly and motivate them to learn and practise better ways of life.

Extension Training, therefore, is a heavy responsibility. *Gram Sevak* trainees come to our training institution with little technical training in the various subjects in which they must develop competence if they are to help villagers in understanding and dealing with their many problems. Even less is their knowledge of and experience with "Extension Methods" which must be adopted to stimulate villagers' interest and participation in development activities.

By and large, it can be said that our training institutions have made a promising start in imparting training in this new sphere. The passing of the years brings its own testing difficulties to such an experiment. All the excitement of the launching has died away. The enthusiast must submit to the rigour of sustained effort. The idealism that inspired tbe championship of an idea must now be directed to its fulfilment in plain hard work.

At this stage some too-impetuous hopes are bound to have been disappointed. Critics who have stood aside for a while return to murmur "We told you so". Plain work wins little praise from those who have taken no part in it. Only results will tell. By this test alone, quite properly, must the Extension Training institutions now be judged.

The eve of the Second Five Year Plan shows the Extension Training institutions, scattered throughout the length and breadth of the country, passing from the experimental stage and becoming an integral and accepted part of our national life. Their contribution to the rural sector of our national economy has been of a high

significance. The thousands of *Gram Sevaks* whom they have trained, form a living proof of their achievements.

The Extension Training institutions may be settling into sustained work, but they have no complacent belief that their achievements and methods are already adequate. There are newer heights to scale. Training methods have to be constantly improved to meet the increasing challenge of the expanding Extension programme.

In fact all the problems of Extension Training were recently discussed in detail at the Third Conference of the Principals of Extension Training Centres and Superintendents of Basic Agricultural Schools held at Simla recently. This conference has made elaborate recommendations regarding the organisation, curriculum and teaching techniques, as well as the equipment and facilities necessary to make the training programmes more effective. These recommendations are receiving careful consideration and it is hoped that their implementation will go a long way in improving the effectiveness of the training programmes working under the guidance of the Directorate of Extension and Training, Ministry of Food and Agriculture.

Research Note

Note on the Performance of Perennial Cottons at the Agricultural Research Station, Kovilpatti.

As part of the study of the performance of perennial cottons in the different ecological tracts of this State, the variety Moco from Brazil and a few others like Caramura, Serido and Serato were raised at the Agricultural Research Station, Kovilpatti during 1949–51. The observations on the performance of these varieties during successive seasons are summarised in this note. Bulk seeds of Moco originally received from Brazil and supplied from Coimbatore during September 1949 constituted the major source of material for study, as also a few plants of Caramura, Serido and Serato raised from small quantities of seeds supplied by the Cotton Specialist during September 1951. The plants were raised in a low fertility wasteland on the farm, spaced 9 feet between rows and 2½ feet between plants in the row, under unirrigated conditions. Data on yield of seed cotton per plant, mean halo-length and ginning percent were recorded for each seasons produce. Since considerable variation in morphological characters was observed in the bulk material of Moco, notes on stem pigmentation, stem-tip hairiness, petal colour, petiole length and leaf index were recorded with standard grades (Hutchinson et al 1938).

The data on yield of seed cotton in grams per plant, mean halo-length and ginning percent of the different varieties, during successive seasons are summarised in Table I (appended). In yield of seed cotton, it is observed that while Caramura, Serido and Serato have started yielding in the first year of planting itself, Moco began yielding from the second year only. However, the level of productivity of Moco is higher than the other varieties in all the seasons. Excepting for lower yields during 1953–54 due to adverse seasonal conditions, the yield level of Moco shows an upward trend in the second and third years, with a decline in the fifth year. Similar trends are indicated in other cases also, although it might take two more seasons to obtain confirmation. As regards mean halo-length, perceptible seasonal fluctuation is noticed in most of the cases. In ginning percent, although seasonal fluctuations are noticed, Moco is consistently superior to the others. A study of morphological characters revealed that Moco was highly variable, with coefficients as high as 27% in stem-tip hairiness

grade and petal colour grade. The material would appear to lend scope for selection in economic characters also. A few desirable plants have been selected for study of progeny behaviour.

The authors' thanks are due to Sri N. Kesava Iyengar, M. A., M. Sc., (London) for suggestions in writing up the note.

Agricultural Research Station, Kovilpatti.

P. V. MARAPPAN.
L. NEELAKANTAN.

REFERENCES CITED

Hutchinson, J. B. et al (1938) The description of crop plant characters and their ranges of variation. Ind. J. Agri. Sci. VIII: 567–92.

TABLE I

S. No.	Variety	Year of Planting	Characters	Seasonal performance				
				1950–51	1951–52	1952–53	1953–54	1954–55
1.	Moco	September 1949	Kapas yield in grams per plant	42·0±11·0	194·2±33·0	174·0±32·1	54 0±21·6	103·3±16·2
			Halo-length in mms.	28·7± 0·5	26·1± 0·4	26·4± 0·4	28·2± 0·5	25·3± 0·4
			Ginning percent	34·0± 0·4	35·0± 0·5	34·0± 0·5	33·0± 1·2	34·7± 0·5
2.	Caramura-II	September 1951	Kapas yield in grams per plant	..	23·6± 9·4	56 7±13 6	25·5±21·6	46·5±13·9
			Halo-length in mms.	..	28·4± 0·4	27·9± 0 8	28·0± 1·6	28·1± 0 7
			Ginning percent	..	26·1± 0·8	27·1± 1·0	28·0± 2·0	29·0± 1·6
3.	Serido	do.	Kapas yield in grams per plant	..	17·5± 4·7	54·5±25·0	23·0± 5·0	44·0±11·4
			Halo-length in mms.	..	28·4± 1·5	24·3± 1·5	25·7± 2·1	27·3± 2·0
			Ginning percent	..	27·0± 1·5	31·8± 2·5	27·8± 1·0	32·3± 1·5
4.	Serato	do.	Kapas yield in grams per plant	..	16·0± 4·2	31·0±12·2	7·0± 0·8	33·3±31·5
			Halo-length in mms.	..	26·5± 1·2	25 3± 1·6	26·1± 0 6	27·3± 1·4
			Ginning percent	..	30·8± 2·2	30·5± 1·6	28·5± 1·5	30·8± 2·3

Gleanings

Viticulture in Rainy Localities: In grape cultivation, climate plays a dominant and vital role. Grapes, though, they flourish at elevations between 3,000 and 6,000 feet above sea level, require a dry, hot weather at the time of development and maturity of fruit. Rains at this stage prove fatal as they cause poor setting and cracking of berries and so they become juice-less, insipid and sometimes, sour too. For this reason, the cultivation of grapes is limited to places which are dry and warm during the fruiting period. Such favourable places are only a few in India, namely Nasik in Bombay; Madura, Salem, Anantapur in Madras and Andhra, parts of Mysore and some localities in the sub-Himalayan region. Before partition the bulk of this fruit was produced in Baluchistan and N. W. F. P., but now, as these areas are no more in India, the acreage has gone down, by more than half and the production is much below the requirements, which necessitates heavy imports. Grape production can be augmented by artificially creating favourable conditions for its growth. This end can be achieved by planting the vines on a South or South-eastern aspect along vertical wire trellises fixed with or strung from two poles and providing a narrow slanting roof above, so as it may allow the maximum sunshine on the trellises but drain off all the rainwater that would otherwise pour on the vines.

On undulating land, where walls have necessarily to be constructed after proper terracing and levelling of the land, thick wires may fixed up horizontally along the walls 3′×3½ feet spart one above the other. A "lean-to" type roof about 4 feet wide of C. C. iron or even of canister sheets may be provided at the top of the wall over the trellises. Three or four trellises of the wire may be an appropriate number, otherwise, the height of the wall will have to be increased and thus the roof may not check water effectively, and an increase in the width of the roof will obstruct sunshine. The vines may be planted about 10 feet apart along the wall and trained in the Kniffen system in which a single upright main stem is raised up to the top wire and from this stem two canes, one on each side, are allowed to grow along the wires till they reach similar canes from the adjoining plants. These horizontal canes form the permanent arms. In fact, the number of wires in the Kniffen system is usually two, but in this case it is advisable to have more than two wires so that we may get more fruit from the same plants. In the plains where terracing is not required, the wires can be trellised from two iron or wooden poles and an "even span" roof provided at the top and the vines planted and trained below this as in the above case. Here, as the roof is on both the sides, the width span may be kept about 6 feet so that it may overhang about 3 feet on either side of the trellises. In case the trellises are laid against the wall, it protects the vines from wind and provides additional warmth by absorbing sun's heat and afterwards radiating the same to the maturing berries. If the wires are fixed on poles and the site is exposed to wind, a hedge or a mud wall on the windward side will have to be provided to serve the purpose of a wind-break.

This method of viticulture was followed by Mr. Coutts in Simla, and his results were quite encouraging. Mr. Coutts, though a tailor by profession, had keen interest in horticulture which led him to establish a flourishing orchard of temperate fruits at Mashobra, a suburb of Simla, where he achieved success in growing grapes by this method in unfavourable climatic conditions. The method is worth a trial in the plains where at present grapes are not grown due to heavy rains. If it gives success it may revolutionise the grape industry and even a common man will be able to eat the fruit. Thus in this method, lies a great promise and hope for the future horticulturist. [N. K.]

[Daulat Ram Thakur, Kanpur Agricultural Journal, 15 (1) Jan. 56 p. 58-59]

Students' Club News

The activities of the Students' Club for the year 1956 were inaugurated on 'th June 1956 by Sri G. R. Govindarajulu, President of the Chamber of Commerce, oimbatore. Sri P. A. Venkateswara Ayyar, Vice-Principal, Agronomist and rofessor of Agriculture, presided on the occasion. Sri Govindarajulu expressed is thanks at the outset for being invited to deliver the inaugural address on this ccasion. Such an opportunity, he said, was quite a pleasure to him, particularly n a College like this that had made its name for the high standard of its education ınd the research work done on various aspects of agricultural improvement. He emphasised that a 'love of the land' was quite essential in every student of agriculture. He concluded his address by expressing the hope that the activities of the Students' Club would extend to many more useful fields of activity.

Mr. D. Paulas, the Club Secretary proposed a vote of thanks at the close of the function.

* * *

On 5—7—1956 the inaugural address of the Students' Club Debating Society was delivered by Sri. G. D. Naidu. In the course of his address, the lecturer emphasised that politics should not figure in any form in any educational institution. Politics should only be in the hands of experts, politicians and the Government. He stressed on the utility of debating societies as a training ground for the future citizens of India and expressed the hope that debates would be arranged at frequent intervals under the auspices of the Students' Club and guidance of the College Principal and professors. The subjects chosen for these debates should relate only to agricultural science and educational subjects.

Dr. N. Krishnaswami, Cytogeneticist, presided over the function. The vote of thanks at the close of the meeting was proposed by Mr. S. Sundaresan.

* * *

Another function of the Students' Club was celebrated on 7th June 1956 when Sri T. S. Avinashilingam Chettiar, B. A., B. L., M. P. and Ex-Minister of Education inaugurated the Social Service League with Dr. Srinivasan, B. A., B. Sc., Ph. D, Lecturer in Agricultural Economics, in the chair.

Sri T. S. Govindarajan, the Secretary of the League proposed a vote of thanks to the learned lecturer at the close of the function.

* * *

An executive meeting of the Students' Club was called on 16-7-1954 to elect an acting Club Secretary in this absence of Mr. Paulas, the Club Secretary, who had been posted to Pattambi for six months' farm training. Sri V. Rajaguru, the class representative of B. Sc., (Ag) III, was elected to this post.

G. RAMANATHAN.

Weather Review — For June, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	5·1	+ 3·2	8·2	South	Madurai	3·2	+ 1·6	5·9
	Tirurkuppam*	3·1	+ 1·1	6·1		Pamban	0·8	+ 0·6	2·0
	Vellore	5·9	+ 3·1	11·8		Koilpatti*	2·9	+ 2·6	7·0
	Gudiyatham*	2·8	+ 0·1	7·2		Palayamcottai	0.4	J.N.	4·3
						Ambasamudram*	1·1	— 0·1	6·4
East Coast	Palur*	7·5	+ 5·8	10·0	West Coast	Trivandrum*	12·9	— 0·3	24·7
	Tindivanam*	4·1	+ 2·9	7·9		Fort Cochin	30·2	+ 1·7	72·2
	Cuddalore	5·6	+ 4·2	7·9		Pattambi*	25·2	— 3·2	42·8
	Nagapattinam	1·7	+ 0·5	4·7		Kozhikode	38·2	+ 3·4	66·4
	Aduthurai*	3·5	+ 2·5	7·0		Taliparamba*	40·1	+ 4·3	62·8
	Pattukottai*	4·2	+ 3·4	7·2		Wynaad*	23·6	+ 9·2	35·0
Central	Salem	4·5	+ 1·4	6·8		Nileshwar*	44·3	+ 0·7	77·4
	Coimbatore (A. M. O.)*	4·4	+ 2·9	6·3		Pilicode*	39·7	+ 0·3	63·0
	Coimbatore	3·6	+ 2·1	5·4		Mangalore	38·1	— 2·1	66·5
	Tiruchirapalli	0·8	— 1·0	3·9		Kankanady*	38·2	— 2·5	67·0
						Kotekar*	38·7	— 1·7	£
					Hills	Kodaikanal	5·1	+ 0·9	17·2
						Coonoor*	3·7	+ 1·6	11·7
						Ootacamund*	6·7	+ 1·6	15·6
						Nanjanad*	11·0	+ 3·3	16·5

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.

2. £ = It is a new station. The raingauge was installed only in March 1956.

3. J. N. = Just Normal.

The month began with a storm centred at 08–30 hours I. S. T. about 80 miles South–West of Calcutta. On the first day of the month, rainfall was widespread in Malabar, South Kanara and fairly widespread in Travancore-Cochin. The monsoon was active on the first four days in the West Coast, while Tamilnad received only very light showers on 4—6—56. This sort of weather continued upto 11—6—56 without any large change. In the subsequent two days rains became localised even in the West Coast, while the weather was dry elsewhere. On 14—6—56 showers were widespread in the West Coast and fairly so in interior Tamilnad. Conditions became favourable on 15—6—56 for the revival of the activity of the Arabian Sea branch of the monsoon along the West Coast. The monsoon strengthened further on the next day in Malabar and South Kanara. On 16—6—56 and the next day as well, rains were widespread in Malabar and South Kanara. On 17—6—56 showers were received at a few places in Tamilnad. The monsoon was vigorous over the South Konkan on 18—6—56 and rains were widespread on this day in Travancore-Cochin and localised in Malabar and South Kanara and at a few places in Tamilnad. The seasonal trough shifted to the foot of the Himalayas on 19—6—56 and rains were fairly widespread in the West

Coast and localised in Tamilnad. Rains continued to be widespread on the next two days in Malabar and South Kanara and localised in Travancore-Cochin and at a few places in Tamilnad. For seven days from 22—6—56 rains were widespread in the West Coast and scattered and localised in Tamilnad. The monsoon became active over the region on 29—6—56. On this day, as well as on the next day, rains were heavy and widespread in the West Coast and fairly heavy in many places in Tamilnad. So the month ended actually with a vigorous monsoon over the region.

Considering the month as a whole, almost all the districts in the Madras State received either abnormal or near about normal rains. The exceptions were Tiruchirapalli and South Kanara Districts. It was rather strange that even South Kanara received only subnormal rains when the monsoon was fairly active during the month in the West Coast.

The noteworthy rainfall and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
14/6/56	Fort Cochin	4·0	North	4·2	+ 1·9	Above normal
19/6/56	Kallakurichi	3·0	East Coast	4·4	+ 3·2	do
21/6/56 & 25/6/56	Mangalore	4·0 (Each day)	Central	3·3	+ 1·4	do
22/6/56	Minicoy	3 0	South	1·7	+ 0·9	do
27/6/56	Mercara	5·0	West Coast	33·6	+ 0·9	do
30/6/56	Kozhikode	9·0	Hills	6·6	+ 1·9	do
30/6/56	Palghat	4·0				
30/6/56	Alleppey	4·0				

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 11—6—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service—Postings and Transfers

Name and present post	Posted as
Adyanthaiah, N. R., Assistant Mycologist, Coimbatore,	Assistant Mycologist, Ootacamund.
Krishnamurthy, C. S., Assistant Mycologist, Ooty,	Assistant Mycologist, Coimbatore.
Mohammad Ali, A. M., Assistant Agricultural Engineer, Madras,	Assistant Agricultural Engineer, Soil Conservation Scheme, Vellore.
Natarajan, T., Administrative Officer, Agricultural College, Coimbatore,	Gazetted Assistant to the Director of Agriculture, Madras.
Raman Moosad, C, Special Marketing Officer, Hosur,	Administrative Officer, Agricultural College, Coimbatore,
Ramaswami, S., Special D. A. O., Tanjore,	D. A. O., Coimbatore.
Sankaranarayana Reddy, Assistant Agricultural Engineer, Soil Conservation Scheme, Vellore,	Assistant Agricultural Engineer, (Civil,) Agricultural College, Coimbatore.

Upper Subordinates

Name and present post	Posted as
Ambikacharan, K , A. D., Conjeevaram,	A. D., Madras.
Balasubramaniam, S., A. D., Walajah,	Extension Officer, Kuruvikulam.
Chockalingam, C. D., A. D., Saidapet,	A. D., Chevyur.
Gnanasambandam, B., Special Marketing Assistant, Pattukottai,	A. D., Muthupet.
Jayaraj, E. V., Special Marketing Assistant, Paramakudi,	A. D., Sivaganga.
Narasimhan, R., Special Marketing Assistant, Trichy,	A D., Pullambadi.
Perumal, A. S., Special Marketing Assistant, Pudukottai,	Extension Officer in Agriculture, Alangudi.
Ramakrishnan, C., Mycology Assistant, Coimbatore,	Fruit Assistant, Coimbatore.
Ramanathan, R , Fruit Assistant, Coimbatore,	F. M., Central Farm, Coimbatore.

Name and present post	Posted as
Dr. Rangaswami, G., Mycology Assistant, (on study leave)	Mycology Assistant, Coimbatore.
Ravindranath Menon, C., A. D., Madras,	A. D., Chevyur.
Ranganatha Prabhu, A. D., Vegetables, Madras,	A. D., Saidapet.
Swaminathan, S., Instructor in Agriculture, T. Kalluppatti,	A. D., Trichy.
Shanmugasundaram, N., Special Marketing Assistant, Madurai,	A. D., Theni.
Vrishabadass, P., Special Marketing Assistant, Thiruthuraipoondi,	A. D., Peravurni.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the month of May, 1956

I. Cotton: (In this section: Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks: Tirupur: Lint: The arrivals of both kapas and lint declined considerably compared to April, 1956. However, the arrivals showed definite improvement over the transactions in the corresponding period of last year. The cotton market at Tirupur opened with 3,986 cdys of Cambodia and 751 cdys of Karunganni lint. Arrivals totalled 11,843 cdys of Cambodia and 1,285 cdys of Karunganni lint which included 3,497 cdys of Cambodia and 192 cdys of Karunganni produced from out of ginneries. 8,465 cdys of Cambodia and 712 cdys of Karunganni were despatched outside the district, including a total of 3,384 cdys of lint sent to destinations in Travancore-Cochin State, Andhra, Madura, North Arcot, Nilgiris, Tirunelveli, Bombay, Ramnad, Tiruchirapalli, Madras, Ahmadabad and Orissa. A closing stock of 7,364 cdys of Cambodia and 1,324 cdys of Karunganni was left over at the closing of 26-5-1956.

The transactions in kapas showed a declining trend during the month. Besides the opening stock of 38,267 pothis of Cambodia and 4,127 pothis of Karunganni kapas, arrivals of 35,895 pothis of Cambodia and 3,529 pothis of Karunganni were accounted for during the period including fair quantities of receipts from Tanjore, Tiruchirapalli, Madurai and Villupuram. A total of 37,490 pothis of Cambodia and 4,029 pothis of Karunganni were disposed during the month, leaving a closing stock of 36,672 pothis of Cambodia and 3,627 pothis of Karunganni at the end of the month. Ginneries were unable to have a normal turnover due to the cut in electricity imposed in these areas. Inspite of better prices, arrivals were poor in both Cambodia and Karunganni, as the growers are holding up against a better future market.

Koilpatti: Arrivals of Karunganni cotton declined considerably and the stock with trade was found shrinking. Millers were reluctant to enter into purchases due to restrictions on electricity for ginning. Arrivals during the month amounted to 695 cdys of Karunganni, besides the carried-over stock of 83 cdys of the previous month. A quantity of 630 cdys was sold locally, leaving a closing balance of 148 cdys. There was no stock of Uganda cotton.

Kapas: The kapas market here started with 1,500 pothis at the commencement of the month. About 4,100 pothis were received during the month from the adjoining villages, out of which 4,000 pothis were ginned and disposed of locally, leaving a closing stock of 1,600 pothis at the end of the month. The arrivals are reported to be low due to restrictions in the use of electricity.

Ramanathapuram District: Arrivals in all the three markets of Virudunagar, Rajapalayam and Sattur declined considerably and consisted mostly of the first crop and were of poor quality. Transactions in lint were brisk and confined to mills.

Lint: The three markets referred to started with an opening stock of 200 cdys of lint while the arrivals were nearly 4,800 cdys. 4300 cdys were sold, leaving a balance of 700 candies.

Kapas: Transactions of both cotton kapas and lint are reported to be limited, owing to the restrictions of current supply to ginning and spinning mills. The kapas brought to the market is said to be only inferior varieties. The kapas market in the above three places had an opening stock of 700 pothis and fresh arrivals of 32,500 pothis were also received during the month. Disposals totalled 28,700 pothis, leaving a stock of 5,500 pothis at month end.

South Arcot District: All the markets of this district received and disposed of seven pothis of cotton kapas during the month. The local crops are reported to be below normal, due to unseasonal conditions in the later stages of the crop.

Cotton Prices: Tirupur: Lint: Cotton market in this centre was quite firm throughout the month and the prices were touching the ceiling rates in most cases, due to better off-take and low availability of kapas and lint.

Kapas: Prices of kapas were also ruling high during the month.

Koilpatti: Lint: Prices of lint in this market opened at the rates of Rs. 856/- to Rs. 870/- per cdy for best quality and advanced to Rs. 875/- towards the middle of month and continued to be firm at that level

till the end of the month. The price is reported to have almost touched the ceiling rate prescribed by the Textile Commissioner, Bombay for Karunganni cotton.

Kapas: Due to the reluctance of sellers who expected a rise in markets due to the failure of the second crop, the prices of kapas went up further during the month and fluctuated between Rs. 108/- to Rs. 124/- per pothi.

Cotton Seeds: The prices of Karunganni seed opened at Rs. 34/- to to Rs. 37/- per pothi and gradually advanced to Rs. 36/- to Rs. 39/- towards the middle of the month and finally closed firm at Rs. 42/- to Rs. 44/- per pothi. The firmness of the market is ascribed to the low stocks of seeds available with the trade and generally fluctuated in sympathy with groundnut oilcake rates.

Ramanathapuram District: Lint, Kapas and Seeds: The opening and closing prices of lint and kapas in the three markets of the district are extracted below. There was a rising trend in the rates of kapas and lint ascribed to restricted stocks, greater demand and low arrivals.

		Opening Rate Per Pothi	*Closing Rate Per Pothi*
Karunganni Kapas I	...	Rs. 102 to 107	Rs. 110 to 114
Karunganni Kapas II	...	Rs. 96 to 100	Rs. 104 to 110
Karunganni Tinny Mixture	...	Rs. 92 to 95	Rs. 98 to 101
Tinny	...	Rs. 88 to 90	Rs. 90 to 96
		Per cdy	*Per cdy*
Karunganni Lint	...	Rs. 835 to 853	Rs. 840 to 835
Tinny Karunganni Mixture Lint	...	Rs. 830	Rs. 830 to 835
Tinny Lint	...	Rs. 816 to 825	Rs. 820 to 830
		Per Std. Md.	*Per Std. Md.*
Cotton Seeds	...	Rs. 10 to 10½	Rs. 13/2 to 13/5

South Arcot District: The average price of cotton kapas ruled between Rs. 76—4—0 to Rs. 89/- per pothi according to quality.

II. **Groundnut:** (In this section: Candy = 531 lb. kernels.
Bag = 80 lb. of pods).

South Arcot District: Harvest of summer groundnut commenced and was proceeding. Harvest operations were impaired by absence of rains. Increased arrivals are expected, especially in Cuddalore, Panruti and Villupuram markets. The transactions of groundnut kernels that took place in all the markets of this district are reported below.

Opening balance	...	3,872 tons.
Arrivals into all the Markets	...	1,100 ,,
Receipts from other districts like Tiruchirapalli, Tanjore and North Arcot	...	826 ,,
Imports from other States like Andhra	...	336 ,,
Consumption by oil mills in the district	...	2,162 ,,
Consumption by country chekkus	...	187 ,,
Despatches to other districts like Madras, Tanjore and Salem	...	120 ,,
Exports to other States like Pondicherry	...	124 ,,
Wastage	...	73 ,,
Closing stock with the trade at the end of the month	...	3,468 ,,

The average price of kernels in the several markets ranged from Rs. 150–4–0 to 164–4–0 per cdy depending upon the quality and remained more or less at the same level as in the previous month. No increase in rates could be expected, due to lack of sustained enquiries from vanaspathi industrialists.

North Arcot District: The markets of this district started with an opening balance of 1,885 tons of pods and 1,584 tons of kernels. The arrivals of groundnut during the month amounted to 1,127 tons of kernels and 358 tons of pods. Despatches from this district amounted to 421 tons to places like South Arcot, Madurai, Coimbatore and Ramanathapuram. The off-take was 1,036 tons of kernels and 555 tons of pods. The markets closed with a stock of 1,688 tons of pods and 1,254 tons of kernels at the end of the month. The arrivals and the off-take were not encouraging during the mouth, due to absence of buyers from the industrial section. The country chekku owners were the main purchasers of groundnut.

The prices of groundnut remained at fairly high levels during the month. The scarcity in stock and limited supply of oil, coupled with the cut in power are the causes for the higher trend in the prices. The prices of kernels ruled at Rs. 155/- to Rs. 169/- per cdy while the prices of pods were quoted at Rs. 16/- to Rs. 20/- per bag.

Ramanathapuram District: Arrivals of groundnut kernels and pods in Virudhunagar market amounted to 2,700 cdys and 250 tons respectively. Disposals in the month accounted for 1,800 cdys of kernels and 250 tons of pods, leaving a closing stock of 900 cdys of kernels only. Harvests of summer crop groundnuts have just commenced in the district. The demand for kernels lessened during the month, leading to the accumulation of stocks. Lack of demand for groundnuts is attributed to power cut imposed on decorticators and mills.

The opening and closing prices of groundnut kernels, pods and groundnut oil that ruled in this market are reported below.

		Opening Rate:	*Closing Rate:*
Groundnut pods (per Md. of 82$\frac{2}{7}$ lb)	...	Rs. ...	Rs. 18 to 18/8
Groundnut kernels per cdy	...	Rs. 155 to 170	Rs. 160 to 172
Groundnut oil (35 lb)	...	Rs. 23 to 23 3/4	Rs. 22$\frac{3}{4}$ to 23
Groundnut oil cake (per Md. of 82$\frac{2}{7}$ lb)	...	Rs. 8/8 to 9/5	Rs. 9/10 to 10

The prices remained practically steady during the month in spite of a low demand for kernels.

Sri R. Doraiswami, I. A. S., Member, Forward Markets Commission visited Madras to study and promote forward trading in groundnut seed, groundnut oil and butter. He held discussions with various trade associations concerned and Government officials in this regard. He felt that forward trading in groundnut oil and seed will minimise the fluctuations in price and that Madras should have one recognised exchange, being an important producing centre.

III. **Gingelly: South Arcot District:** (In this section: Candy=168 lb.)

Stocks: Arrivals of gingelly, being off season, were poor. Besides the total of 454 bags of gingelly seeds at the beginning of the month in all the markets, arrivals during the month amounted to 223 bags, of which 191 bags were from Virudachalam market alone. Receipts from Tiruchirapalli came to 107 bags. Disposals for consumption by the country chekkus and for despatches to other districts like Tirunelveli and North Arcot came to 350 bags and 200 bags respectively, leaving a closing stock of 234 bags.

Prices: The average price ruled higher in the several markets and varied from Rs. 67—12—0 to Rs. 76—10—0 per bag according to the quality, due to low availability and great demand.

IV. **Coconut and its products:** (In this section: Cdy = 700 lb.)

Coconuts; Stocks: Market arrivals of coconuts were fairly heavy with good demand from Bombay, and transactions of coconuts in the markets of Malabar and South Kanara districts are extracted below:

(*In thousands*)

Name of the market		Opening balance	Arrivals	Disposals	Closing balance
Malabar District:					
Kozhikode	...	7,065	4,500	4,100	7,465
Badagara	...	873	1,015	1,110	778

(In thousands)

Name of the market		Opening balance	Arrivals	Disposals	Closing balance
Malabar District: Contd.					
Ponnani	...	Not Reported (N. R.)			
Tellicherry & Dharmadam	...	667	987	1,003	651
South Kanara District:					
Mangalore	...	55	260	240	75

Prices: The opening and closing prices of coconuts in Malabar and South Kanara districts for the month of May, 1956 are reported below. The prices were unsteady and tended to close slightly lower, due to greater availability in the monsoon season.

Malabar District: (Husked, per 1000.)

		Minimum	*Maximum*
Kozhikode	...	Rs. 115	Rs. 102
Badagara	...	„ 125	„ 120
Ponnani	...	„ N. R.	„ Nil
Tellicherry & Dharmadam	...	„ 125	„ 120

South Kanara District: Prices of coconuts were more or less steady in Mangalore.

Mangalore, Raw	Rs. 120	Rs. 150
do. Dry	Rs. 145	Rs. 190

Copra: Stocks: The stock particulars of copra in the markets of Malabar and South Kanara districts are extracted below:

Market		Opening balance	Arrivals	Disposals	Closing balance
Malabar district:					
Kozhikode	...	5,988	5,800	6,300	5,488
Badagara	...	490	3,600	3,580	510
Mangalore (In Tons)	...	109	687	680	116

Prices: (a) The minimum prices of copra in Malabar district as between the different varieties are reported below.

(Prices in Rs. per candy)

Variety		*Kozhikode* Minimum	*Kozhikode* Maximum	*Badagara* Minimum	*Badagara* Maximum
Office	...	Rs. 285	Rs. 300	Rs. 290	Rs. 297
Edible	...	„ 290	„ 305	„ 290	„ 305
Madras	...	„ 300	„ 300	„ 300	„ 300
Rajpur	...	„ 325	„ 345	„ 322	„ 325
Gola	...	„ 302	„ 318	—	—

The prices of copra ruled a little high, owing to the restricted arrivals on account of heavy rain and good demand from millers.

(b) The prices of copra ruled firm at Mangalore market at Rs. 275/- to Rs. 300/- per cdy.

V. **Arecanuts:** (In this section: Bag = 100 lb.)

Stocks: The stock particulars of arecanuts in the Markets of South Kanara and Malabar districts during this month are extracted below:

District,	*Opening Stock.*	*Receipts*	*Disposals*	*Closing Stock.*
Mangalore (in cwts)	26,252	24,000	27,640	22,612
Kozhikode ...	Nil.	Nil.	Nil.	Nil.

Prices: The prices of arecanut *(supari)* in Mangalore of South Kanara district as between the different varieties are reported below.

(Price in Rs. per cwt.)

		Minimum	*Maximum*
Koka	...	Rs. 80	Rs. 115
Choll	...	No stock.	
Malabar Supari	...	,, 128	,, 142
Mangalore ,,	...	,, 135	,, 162

The prices of *supari* were practically steady during the month with an uncertain tendency because of large stocks. There were no transactions of arecanuts in Malabar district.

VI. **Tobacco:** (In this section: Cdy = 500 lb.)

Stocks: The tobacco market in Tirupur started with an opening balance of 6,280 cdys of chewing and 1,400 cdys of cheroot variety during the month. About 25 cdys of beedi tobacco arrived from Bombay and Mysore States. A small quantity of cheroot tobacco arrived from Bombay and Mysore States. About 2,880 cdys of chewing and 600 cdys of cheroot varieties were despatched to places like Palghat, Travancore-Cochin State, Malabar, Ramnad, Tiruchirapalli, Tanjore, North Arcot. There was a closing stock of 11,015 cdys of chewing tobacco and 2,150 cdys of cheroot tobacco at the end of the month.

Prices: The price ranges of different varieties of tobacco in Tirupur market are furnished below.

(Prices in Rs. per cdy of 500 lb.)

Variety		*I grade*	*II grade*	*III grade*
1. *Chewing Tobacco, Sun-cured:*				
Meenampalayam	...	300 — 350	200 — 270	100 — 170
Other varieties	...	250 — 310	190 — 220	110 — 135
2. *Cheroot varieties.*				
Sun-cured (grown in Erode and Bhavani Taluks.)	...	260 — 360	160 — 240	100 — 140
3. *Chewing varieties:*				
Pit-cured (grown in Palladam and Sulur areas.)	...	250 — 350	175 — 250	100 — 150

Review of the Administrative Activities of the Market Committees during May, 1956

All the Market Committees continued to function during the month under Section 6A of the Madras Commercial Crops Markets Act under the respective district revenue authorities except the Coimbatore Market Committee which is working under an elected body. Action is being taken for holding fresh elections in other Market Committees. The stalemate in Tirunelveli Market Committee and Ramanathapuram Market Committee still continues, due to the legal opposition by a block of traders whose writ petition is pending in the Supreme Court.

The following progress was made by the Market Committees in the issue of licenses under the provisions of the Madras Commercial Crops Markets Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	92	633	51	469	47	280	2	5
South Arcot Market Committee	65	1064	56	948	54	880	—	6
Coimbatore Market Committee	142	546	137	580	107	441	8	12
Tirunelveli Market Committee	—	3	—	1	—	—	—	—
Ramanathapuram Market Committee	—	4	—	3	—	—	—	—
Malabar Market Committee	21	252	108	1137	23	175	—	5
South Kanara Market Committee	16	206	16	177	1	56	—	—

II. **Meetings:** No meetings were held by the Coimbatore Market Committee during the month. Other committees are functioning under 6-A. of the Act. The South Arcot Market Committee however, put before the Ex-Officio chairman 58 subjects, which were passed.

III. **Quality appraisal:** The South Arcot Market Committee continued its work on the analysis of groundnut kernels marketed in that district. During the month 369 samples were drawn and analysed in five markets from out of arrivals of 12,670 bags of groundnut kernels in 3,125 lots. The total common refraction was below 4% in 247 samples 5 to 8% in 116 samples and above 8% in six samples. The details of such analysis, which may be of interest to readers, are extracted below:

Particulars	Cuddalore	Tindivanam	Virudhachalam	Panruti	Tirukoilur.	Villupuram
1. *Dryage:*						
2% and below ..	—	1	54	1	4	—
above 2% and upto 3% ..	11	—	26	—	—	—
above 3% and upto 4% ..	12	26	11	—	21	—
above 4% and upto 5% ..	23	7	1	—	—	—
above 5% and upto 10% ..	70	6	1	5	53	—
above 10% ..	6	29	—	1	—	—
2. *Total refraction:*						
4% and below ..	57	50	64	3	73	—
above 4% and upto 8% ..	60	19	29	3	5	—
above 8% ..	5	—	—	1	—	—

IV. **Quality competition:** The continuance of the scheme of quality competition for 56–57 in the South Arcot Market Committee has been sanctioned by Government. The summer crop competition is proposed to be run from 1–6–1956 to 30–9–1956 in all Markets except Chinnasalem and Kallakurichi where it will run from 1–9–1956 to 30–11–1956. The winter crop competition will be run from 1–11–1956 to 28–2–1957 in all the markets of South Arcot Market Committee.

Review of the Administrative Activities of the Market Committees during June 1956

1. All the Market Committees continued to function under 6A of the Act except Coimbatore Market Committee, which is functioning under an elected body. The election of members for the reconstitution of the committees in the districts of Malabar and South Arcot was held. The stalemate in the districts of Ramanathapuram and Tirunelveli caused by a writ petition continues.

2. The following is the issue of licences by the Market Committees.

	Section 5 (1)		Section 5 (3)		Weighmen		Brokers	
	A	B	A	B	A	B	A	B
South Arcot Market Committee	111	1175	80	1028	74	954	—	6
North Arcot Market Committee	106	739	61	530	52	332	1	6
Coimbatore Market Committee	102	648	112	692	53	494	—	12
Tirunelveli Market Committee	7	10	11	12	2	2	—	—
Ramanathapuram Market Committee	16	20	17	20	—	—	—	—
Malabar Market Committee	29	281	84	1221	50	225	—	5
South Kanara Market Committee	21	227	16	193	—	56	—	—

II. **Meetings:** No meetings were held by the Coimbatore Market Committee during the month. Other Market Committees are functioning under their respective revenue heads. The Collector and ex-Officio Chairman of South Arcot Market Committee, passed orders on 22 subjects.

III. **Quality appraisal:** The South Arcot Market Committee continued its work on the analysis of groundnut kernels marketed in that district. During the month 257 samples were drawn and analysed from out of 7,089 lots in 27,393 bags of arrivals during the month. Total refraction was below 4% in 142 samples, 5 to 8% in 101 samples and above 8% in 14 samples. Individually the dirt and foreign matter in the samples analysed in the various markets

are within 4% mutual in all the samples. In respect of dryage, Virudhachalam accounted for a minimum of 2% and below in 69% of the samples analysed, as against in 11% and 14% of the samples at Tindivanam and Panruti respectively and nil in other markets which recorded higher percentage of moisture ranging between 4% to 10% mostly. The details of analysis are extracted below:

Particulars	Tindivanam	Tirukoilur	Virudhachalam	Panruti	Villupuram	Cuddalore
1. *Dryage:*						
2% and below ...	8	1	40	5	—	—
above 2% and upto 3% ..	—	1	11	1	1	1
above 3% and upto 4% ..	14	3	4	—	3	15
above 4% and upto 5% ..	24	2	3	—	1	9
above 5% and upto 10% ..	23	10	—	15	10	21
above 10% ..	3	—	—	13	—	8
2. *Total common refraction:*						
4% below ..	52	5	45	19	3	18
above 4% and upto 8% ..	20	6	13	15	4	43
above 8% ..	—	6	—	—	8	—

IV. **Quality competition:** Twenty entries were secured by the South Arcot Market Committee for summer crop quality competition which began on 1—6—1956.

V. **Special features:** Two batches of trainees in Co-operative Marketing Institute from Poona and Ranchi visited some of the Regulated Markets of Cuddalore, Villupuram and Vridhachalam during the month and they were apprised of the working of the markets and the method of closed bidding for auction for disposal of commercial crops in these markets. The remarks made by the visitors are extracted in the appendix.

Remarks made by the visitors at Cuddalore (O. T.) Market

Visitor: **R. K. Apte,** *Special Officer in charge of Co-operative Training Class 1st Batch, Poona; 6—6—1956. Sri Apte visited the market in company with officer trainees:*

"The Secretary explained to us the working of the market in detail. We are glad to note that this regulated market is able to command 90% of the groundnut crop for sale. It is handicapped for space and buildings etc. It is hoped that it would be possible to obtain a larger area and provide more amenities to the sellers. The sellers are assured of correct weighment and competitive price and saved from malpractices".

* * *

Remarks made by **Sri Kedar, Pd. Sinha,** *Lecturer, Regional Co-operative Training Centre, Ranchi, Bihar, who visited Cuddalore (O. T..) Market on 16—6—1956.*

"Visisted the market with a group of trainees of the Regional Co-operative Training Centre, Ranchi, Bihar. I am very glad that this Market Committee has done pioneering service to the growers of this district and it is on the basis of its services that now the Committe controls about 98% of the market in groundnut in this district. This success is really a notable step in the co-operative movement in the country".

* * *

Remarks made by **Sri R. K. Apte, B. Ag.** *Special Officer, Co-operative Training College, Poona, at Villupuram Market, on 7—6—1956.*

"Visited the Market. The Secretary and other office-bearers showed us round and explained to us in detail the working of the market. We saw the tenders being opened and the highest bids declared. The ryots were informed of the highest prices offered for their lots and then with their consent, the sales were confirmed. We saw the nice buildings where the produce on arrival is arranged. We also saw the godown where the stock not sold the same day and desired to be left for sale in future is stored. We were also glad to see the work done in the laboratory. The growers are assured of correct weighment and highest price. They have been provided with necessary amenities. The market is well managed. Prices from different markets are put on the board. I wish every success to this useful institution".

* * *

Remarks made by Officer Trainees of the All India Co-operative Training College, Poona at Villupuram Market, on 7—6—1956.

"We have had an opportunity of visiting the South Arcot District Market Committee, Cuddalore and its sub-yard at Villupuram during our study tour and are glad to say that the Market Committee has done its best to safeguard the interests of the producers of the district by regulation of the sale of their produce. The Market yard at Villupuram with all the amenities provided in it is an ideal one. The elimination of commission agents by the Market Committee is indeed a commendable feature which deserves emulation by other Market Committees".

Remarks made by **Sri Kedar Prasad,** *Lecturer, Regional Co-operative Training Centre, Ranchi, Bihar, at Villupuram Market, on 18—6—1956.*

"This is the second market yard under the South Arcot Market Committee which I visited, along with a group of trainees of my centre. The Market Committee offers the best floor from which the growers can get a fair price for their crops. Furthermore by adoption of the system of sealed tenders cut-throat competition is largely eliminated and even a small ghaniwalla gets an opportunity to make his purchases.

The Committee with its nine market yards has now captured 98% of the local markets in groundnut and other commercial crops. This shows the measure of service rendered to the growers".

* * *

Remarks made by **Sinha,** *Lecturer, Regional Co-operative Training Centre, Ranchi, at Vridachalam Market, on 26—6—1956.*

I have been asked to express my views on the working of the market yards under the South Arcot Market Committee, the other two market yards being Cuddalore Market Yard and Villupuram Market Yard. This is by far the biggest market yard we have so far visited. Today's arrivals numbered 1000 bags and the busy season is still some months off. The trainees accompanying me were able to study the principles and technique of a successful agricultural market. My impressions of the working of this market-yard confirm the views which I have already expressed earlier, that through this market yard both the growers and the traders are benefited to the full. The secret bidding system which is adopted in all the market yards serves to eliminate cut-throat competition and saves petty traders from being ousted by big traders. The Market Committee is in the best position where it can take up the responsibility of improving the grade and quality of groundnut. Through judicious propaganda and annual quality competitions the Committee can make easily encourage the growers to improve the quality of their produce.

Crop & Trade Forecast

Gingelly—Fourth or Final Report—1955—'56—Madras State: The area sown with gingelly *(Sesamum)* in Madras State in 1955-'56 is estimated at 392,200 acres. Compared with the final area of 398,500 acres for 1954-'55, the present estimate shows a decrease of 1.6 per cent. The present estimate reveals an increase of 3.2 per cent over the average area of 380,000 acres calculated for the five years ended 1954-'55. The area under the crop in the Nilgiris district is negligible. An increase in area is estimated in the districts of Chingleput, North Arcot, Salem, Tiruchirapalli and Tanjore and a decrease in the other districts of the State.

The crop has been or is being harvested in most districts of the State. The yield per acre is estimated to be normal in the districts of Tirunelveli and Malabar and below normal in the remaining districts. The Seasonal Factor for the State as a whole works out to 94 per cent of the normal, as against 96 per cent for the previous year. On this basis, the total yield works out to 48,300 tons as against 50,000 tons estimated for the previous year, representing a decrease of 3.4 per cent. Compared with the average yield of 42,7000 tons calculated for the five years ended 1954-'55, the present estimate is an increase of 13.1 per cent. The wholesale prices of gingelly seed per standard maund of 82$\frac{2}{7}$ lb or 3,200 toles, as reported from important market centres on 11-4-56 was Rs. 38-0-0 at Tuticorin, Rs. 37-0-0 at Tirunelveli, Rs. 34-0-0 at Salem and Rs. 33-9-0 at Cuddalore. Compared with the prices which prevailed on 9-4-55, these prices show an increase of 85.0 per cent at Tirunelveli, 74.7 per cent at Tuticorin, 69.5 per cent at Salem and 67.3 per cent at Cuddalore.

Onions—Second and Final Forecast Report—1955—'56—Madras State: The area under onions in the Madras State in 1955-'56 is estimated at 29,100 acres. Compared with the final area of 28,500 acres and an average area of 24,100 acres calculated for the five years ending 1954-'55, the present estimate is an increase of 2.1 percent and 20.7 percent respectively. The area estimated is the same as that of last year in the districts of Chingleput, South Arcot, North Arcot, Tanjore and the Nilgiris. A decrease in area is estimated in Madurai and Ramanathapuram districts and an increase in the other districts of the State except Malabar and South Kanara where the area under the crop is little or negligible.

The main crop has been harvested. The seasonal factor for the State as a whole works out to 95 percent of the normal as against 94 percent of the normal estimated for the previous year. On this basis the total yield works out to 141,000 tons as against 137,800 tons estimated for the previous year and an average yield of 103,100 tons calculated for the previous five years representing an increase of 2.4 percent and 36.9 percent respectively. The average wholesale price of onions per maund of 82$\frac{2}{7}$ lb or 3,200 tolas as reported from important market centres on 11th May 1956 was Rs. 6-8-0 in Coimbatore, Rs. 6-2-0 in Tirunelveli, Rs. 5-4-0 in Madurai and Rs. 3-11-0 in Tiruchirapalli. Compared with the prices which prevailed in the corresponding period of the previousyear, these prices reveal an increase of 30.0 percent in Coimbatore, 1.38 percent in Tirunelveli and a decrease of 15.8 percent in Tiruchirapalli.

The Madras Agricultural Journal

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Editorial

Thirty-Ninth College Day and Conference 1956: This annual function of the Madras Agricultural Students' Union, was celebrated this year with great eclat on the 7th and 8th August. The College Day and Conference was inaugurated on the 7th by Sri M. Bakthavatsalam, Minister for Food and Agriculture, Madras, after Sri R. M. Sundaram, Director of Agriculture, and Dr. K. C. Naik, Principal of the Agricultural College had welcomed the gathering and delivered their introductory speeches on the occasion. A symposium entitled "Modern Trends in Indian Agriculture" was inaugurated on the 8th by Dr. J. S. Patel, Additional Agricultural Commissioner, Planning Commission, Delhi. There was a large gathering of leading agriculturists for the Conference and Symposium, besides officials, students and other members of the public. While initiating the symposium, Dr. Patel delivered a very thought-provoking address on the role of the agricultural research worker and the extension officer in a welfare state.

The Golden Jubilee of the Chemistry Section of the Agricultural Research Institute was celebrated on August 9th, with Dr. V. Subramaniam, Director, Central Food Technological Research Institute, Mysore, presiding. Among those who attended and participated in this celebration were Dr. Gilbert R. Muhr of the American Technical Co-operation Mission and Prof. David V. Ter. Avanesyan of the U. S. S. R. Dr. Subramaniam in the course of his very inspiring address, stressed on the need for scientists to keep in close touch with the problems of the common man. A number of interesting papers were then presented on "Chemistry in aid of Agriculture". On Friday, the 10th August, the Union held its annual General Body Meeting in

the morning and elected the office bearers for the ensuing year, while in the afternoon the Farmers' Day of the Central Farm was celebrated, with Sri M. S. Palaniappa Mudaliar B.A. presiding. A number of progressive farmers participated in the discussion that followed the presidential speech by Sri M. S. Palaniappa Mudaliar, amongst whom special mention may be made of Sri C. L. Sundararajan B. Sc. (Ag.) an old student of the Agricultural College, Coimbatore and one of the progressive farmers of Coimbatore at present. Sri Sundararajan recounted some of his observations and experiences during his recent visit to Australia to study the main trends of Australian agriculture.

The College Day Week concluded on the 11th, with the Departmental Officer's Conference.

Perhaps the most remarkable feature amongst the various modern trends noticeable in Indian agriculture is a growing awareness of the fact that the Indian farmer is a complex personality, which necessitates a more effective psychological approach in tacklings problems relating to rural welfare. As Dr. Patel pointed out in the course of his address, the shortest way may not always be the quickest or the best and a due appreciation of all the factors involved is needed for chalking out effective lines of action.

THE THIRTY-NINTH COLLEGE DAY AND CONFERENCE
1956

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Welcome Speech by the Principal, Agricultural College and Research Institute, Coimbatore

Hon'ble Minister for Agriculture, Mr. President, Ladies & Gentlemen,

I deem it as a high privilege, as Principal of this Agricultural College and Research Institute and as President of the Madras Agricultural Students' Union, to welcome you all on this occasion of the Thirty-ninth College Day and Conference. The Union is very grateful to Hon'ble Sri Bakthavatsalam, Minister for Agriculture who has very kindly consented to inaugurate this Conference. The Union as well as the entire Department of Agriculture is indeed very fortunate in having his able guidance and sustained interest and we owe him a deep debt of gratitude for his personal and active help in the development of our department, including the educational side.

We are also happy to welcome on this occasion Dr. J. S. Patel, Additional Agricultural Commissioner, Planning Commission. Dr. Patel is no stranger to us, as he was the first Oilseeds Specialist in our department from 1930 to 1938, when he endeared himself to one and all by his suave manners, adding lustre to this institute by his research achievements. We look forward to his able guidance in our discussions during the Symposium.

We are specially fortunate this year in having our Director of Agriculture to preside over this gathering. For over a dozen years he has been connected with this Institute and department, either as Secretary to Government in the Agricultural Department or as Director. His rich and unique experience, no less than his profound knowledge of agriculture are bound to make this an event of more than ordinary significance.

Agricultural educaion is becoming increasingly attractive to our young men and women and this year the number of students was increased from 108 to 162 in the first year, for which 540 applications were received. The new classes have commenced functioning from the 18th of last month. There are four girl students in the first year class, which also includes four students from Coorg, one from Malaya and one from Africa.

In the final examination of the B.Sc., (Ag.) course held recently, 73 students were successful, out of 78 candidates who appeared for the examination under the new regulations and 14 under the old regulations. The six months' practical training that was included since last year for the final year students under the new regulations continued to work well. The 94 students were divided into batches and distributed for this six months' practical training at the following research stations; Central Farm, Coimbatore and Agricultural Research Stations at Koilpatti, Pattambi, Mangalore, Aduthurai and Tindivanam, on a linguistic basis as far as possible.

The Institute continues to attract a number of students who are eager to take up post-graduate research work, leading to higher degrees like the M. Sc., or Ph. D., of the Madras University. During the year seven students registered themselves for the M. Sc. and Ph. D. degrees and there are now 20 students working for the M. Sc., and five for the Ph. D. Three students secured the M. Sc. degree during the year. There can be no two opinions on the need to improve the facilities available in the Institute for post-graduate work as we are now compelled to reject an increasing number of applicants for want of such facilities in many of the sections.

In this context, I would venture to suggest that a full-fledged post-graduate research centre might be instituted at Coimbatore at an early date. For this purpose, the Freeman Building which is now functioning as the College for the B. Sc. (Ag.) students, can be readily converted with the requisite additional equipment. In the Five-Year Plan, provision has been made at a total cost of about 38 lakhs of rupees for the erection of a new Agricultural College building in the vicinity of the existing one, with the addition of the necessary hostel and other facilities and there can be no more opportune moment than this to set up a separate post-graduate research centre for agricultural research, utilising the Freeman Buildings with its laboratories. The Joint Indo-American Team, which went round the country last year, after a visit to leading centres of agricultural education and research in U. S. A., have stressed upon the urgent need for upgrading agricultural research, suggesting five centres for the purpose, among which Coimbatore is specifically included. A post-graduate research centre at Coimbatore on the lines suggested by the Team would be the most effective way to up-grade the quality and output of

research work in the years to come. In fact, in the context of the rapid developments that are taking place all around us in every branch of science, it is essential to have such a centre if Coimbatore is not to lag behind other centres of agricultural research.

The University of Madras is getting ready to celebrate its centenary next year and on such a happy occasion it would be most fitting that two or three chairs are endowed for research in agricultural sciences, thus providing a fillip for the promotion of research at the highest possible standard.

The post-graduate diploma course in horticulture which had been suspended for a short period was revived from August 1955, with a strength of 31 students. This course comes to an end on 14th August 1956. The refresher course for young farmers started on 25th July 1956 with 30 students on the rolls at present.

The Chemistry Section which completes fifty years of existence is celebrating its Golden Jubilee the day after tomorow. Very soon, it is hoped that this Institute itself will have the opportunity of celebrating its Golden Jubilee.

The Madras Agricultural Journal which forms one of the most useful activities of the Madras Agricultural Students' Union, both to the public and to the workers of this department, continued its publication regularly, in spite of inadequate financial resources. At present the department's publication activities have assumed considerable proportions. Besides the Madras Agricultural Journal which depends upon the public and governmental support there is the South Indian Journal of Horticulture which is also languishing for want of sufficient financial assistance, though receiving an annual grant from the Indian Council of Agricultural Research; the proceedings of the Annual Scientific Conference which is compiled at this Institute but published in the Government Press, the Grow-More-Food Journals which are also compiled partly by the officers of this Institute but published in the Government Press, a large number of leaflets, bulletins, monographs and books published in a similar way, mainly by the efforts of the workers of this Institute. It is a question for serious consideration if it is not possible to canalise all these activities and enhance their usefulness by adequate support of the Government and the Public. I have no doubt that the Madras Agricultural Students' Union will be only too glad to place its services in our endeavour to ensure both regularity of

publication of these and also to enhance the standard of the same. A few years ago we had a very useful publication issued from this Institute by the Association of Economic Biologists. Even though stalwarts like Dr. Patel of the Planning Commission, who will be guiding our discussions now, and Sri K. Ramiah (now working for the Food and Agriculture Organisation in Bangkok) had been associated with that publication, it had to go out of existence for lack of continued financial support. I venture to suggest that a unified agency located at this Institute for all scientific and popular publication activities on agriculture would go a long way to improve their usefulness. The contributions of the Boyce Thompson Institute may well serve as a model of what can be achieved when adequate publishing facilities are provided for an experienced organisation of research workers. Based on the sound principle that prompt publication of research work is as important as the research itself, the workers of the Boyce Thompson Institute purchased space in the Botanical Gazette and American Journal of Botany, but very soon they found it necessary to have a separate journal for their Institute. Nearer home, with increased financial facilities that were made available, the publications of the I. C. A. R. have improved their standard to such an extent that they serve to point the way as to how we too can improve the standard of our publications out of all recognition if sufficient financial help is forthcoming. The Joint Indo-American Team had also recommended that the Indian Council of Agricultural Research and the Government should extend substantial financial assistance to scientific bodies and develop the publication side in agricultural research. A long-standing periodical such as the Madras Agricultural Journal would indeed be a fitting case for such aid from the Indian Council of Agricultural Research or the Government. On behalf of the Madras Agricultural Students' Union and its sister organisation, the South Indian Horticultural Society, I desire to assure the public that we will spare no effort to give an increasingly useful standard of service, provided we are assisted materially by both the public and Government support in the matter of adequate finance.

In conclusion let me once again extend our hearty welcome to you, Sir, to this annual function of ours. as also to our Director and to all other distinguished visitors including the members of the public and other officers of this Department who have assembled here today.

Report of the Secretary, of the Madras Agricultural Students' Union.

I extend to you all a hearty welcome and I have great pleasure in presenting to you on behalf of the Madras Agricultural Students' Union, the report for the year 1955 – '56.

It is indeed very fortunate that we are having amidst us today, the Hon. Sri M. Bhakthavatsalam, Minister for Agriculture, Sri R. M. Sundaram, Director of Agriculture and Dr. J. S. Patel, who has kindly agreed to preside over the symposium. I have great pleasure in expressing our feeling of cordial welcome to them and the other officials and non-officials present here.

Madras Agricultural Students' Union: It was in 1911 that this Union was started by a few enthusiastic workers, to bring together the associates and students of the Agricultural College here, with its predecessor the Saidapet College of Agriculture. The Union, though it was originally started as an organisation to serve as a link between the past and present students, has at present enlarged its scope considerably, having in its fold most of the officers of the department, progressive agriculturists and the students. Through the medium of the Madras Agricultural Journal, and these annual conferences, the Union can claim to have succeeded in a large measure, in bringing together both research and extension workers, as well as practical agriculturists.

Madras Agricultural Journal: The Journal has now come to function as one of the recognised media for the co-ordination of the results of research and for a wider spread of knowledge regarding developments in agriculture. The journal is being published regularly every month, in spite of all difficulties. It has in its exchange list a large number of periodicals, both Indian and foreign, and is being abstracted in leading abstract journals of the world.

Market Committees' Chronicle: The Market Committees' Chronicle was continued to be published in the Madras Agicultural Journal as a supplement devoted to the activities of Market Committees, in the regulation of agricultural markets. We acknowledge with thanks the help rendered by the State Marketing Officer in the publication of Market Committees' Chronicle.

Finance: The publication of the Madras Agricultural Journal is the chief activity of the Union. It is, however, a matter for regret that the income derived by way of subscriptions is not

commensurate with the expenditure incurred in the publication of the Journal. A special grant of Rs. 1,800/- has been forthcoming from the Government of Madras since 1947-48, and for this the Union desires to place on record its gratitude to the Madras Government. The above amount was sanctioned by the Government in order to compensate the loss sustained by the Union, by supplying the journal to the students of the Agricultural College at a concession rate of Rs. 3/- per year, though the actual charges come to Rs. 6/- per annum. In view of the increased admissions, this amount may have to be increased correspondingly, for which a separate request is being made. It is our earnest hope that the Government will consider this appeal sympathetically and accede to our request. We are also grateful to the Madras Government for sanctioning in April 1956, a sum of Rs. 1,000/- for bringing out a special number, incorporating all the papers received for the last year's symposium. We request that this grant may be made a perennial one, so as to enable us to publish the special number immediately after the College Day Conference each year.

The College Day Conference, 1955: The 38th College Day and Conference was celebrated from the 19th to 22nd August 1955. The Conference was inaugurated by the Hon. Sri A. P. Jain, Union Minister for Food and Agriculture. Dr. T. S. Sadasivan, Director of the University Botany Laboratory, delivered the presidential address and the subsequent sessions were presided over by him. A Symposium on "What Next in Agricultural Research and Extension" was organised, which aroused considerable interest and keen discussion.

A notable change during last year was the formation of a permanent Central Exhibition in which the main activities of the Institute are depicted to laymen as well as scientists. We were indeed happy to recall that the Hon. Sri K. Kamaraj Nadar, Chief Minister of Madras, inaugurated the Central Agricultural Exhibition of the Institute during last year's College Day Celebrations. All are requested to visit the Central Exhibition.

Ramasastrulu Munagala Prize: The Ramasastrulu Munagala Prize for the year 1956 has been awarded to Sri K. Rajagopalan, Assistant in Paddy, Agricultural College and Research Institute, for his paper "Variability in size and frequency of stomata in leaves of rice varieties and its correlations in drought resistance", which was adjudged the best by a panel of three judges. Our thanks are

due to Sri T. R. Narayanan, Plant Physiologist, Dr. K. Subramanian of the Southern Centre, Botanical Survey of India and Sri D. V. Krishna Rao, Government Agricultural Chemist, Agricultural College, Bapatla. Our hearty congratulations to Sri K. Rajagopalan.

Debating Contest: In response to the request of student members of the Union, a debating contest was introduced this year and we are glad to announce that Messrs. S. Lakshminarayanan and G. Ramanathan were awarded the first and second prizes respectively. Our congratulations to them, and thanks to the three judges, Mrs. Gonsalves, Dr. Naik and Dr. K. Subramaniam.

Patrons: We are extremely happy to record the enrolment of as many as eight Patrons during the year and the Union has great pleasure in welcoming as Patrons: Sri K. Rangachari, Landlord, Saidapet, Dr. T. S. Sadasivan, Director of the University Botany Laboratory, Sri C. M. John, Retired Principal of the College, Sri S. N. Venkataraman, Retired Headquarters Deputy Director of Agriculture and an old student of the College, Sri N. Chandappa of Mettupalayam, Sri V. Venugopal of Coimbatore, Sri Bhaskaran of Pattiveeranpatti and Sri A. Ayae Gownder of Kasipalayam. It is also worthy of mention that the list of patrons is quite a balanced and representative one, including both eminent research workers and progressive Agriculturists.

Retirements: During the year under report, the following members of the Union retired from active Government Service. They are Sri S. N. Venkataraman, Sri M. A. Sankara Iyer, Sri R. Balasubramanian, Sri S. Mayandi Pillai, Sri Katchapeswara Iyer, Sri P. K. Parameswara Menon, Sri T. Radhakrishnan, Sri P. N. Nair, Sri K. M. Venkatachalam Pillai and Sri K. P. Ananthanarayana Iyer. We wish to place on record our sincere appreciation of the services rendered by Sri S. N. Venkataraman, R. Balasubramanian and M. A. Sankara Iyer to the Union as its functionaries. The others are members of long standing who have helped the Union in various ways, for which our thanks are due to them. We wish them all a very happy, peaceful and long life, after retirement.

Obituary: We record with deep regret the premature demise of Sri K. K. Nambiar, Secretary of the Indian Central Arecanut Committee.

Acknowledgments: Now it is my pleasant duty to express on behalf of the Union, our thanks to all those who have helped the

Union in different capacities during the year. We are deeply grateful to Sri A. P. Jain for inaugurating the conference last year. To Professor T. S. Sadasivan, who delivered the presidential address and conducted the proceedings of the Symposium as well as the Scientific Workers' Conference with marked distinction, we render our heartfelt thanks. To Sri M. S. Sivaraman and Sri P. P. I. Vaidyanathan, two Directors of Agriculture during the year, the Union is grateful for their kind help and guidance in all the matters of the Union. To Sri R. Balasubramanian, Retired Principal, the Union expresses its heartfelt thanks for his valuable help in making the College Day and Conference last year, a grand success. Our thanks are also due to all the ladies and gentlemen, who helped in various ways for the success of the College Day and Conference 1955 and during this year.

Speech delivered by Sri R. M. Sundaram, I. C. S.,
Director of Agriculture, Madras

Hon. Mr. Bhakthavatsalam, Ladies & Gentlemen,

I am grateful to the Madras Agricultural Students' Union for giving me this opportunity to preside over the College Day and Conference. I am not a stranger to you and I am particularly grateful to the Hon. Minister for Agriculture for giving me this opportunity to serve the agriculturists of Madras for a second term as Director of Agriculture.

In a country in which over 75% of the population is engaged in agriculture, it is needless to stress that the greatest industry is agriculture and the economic prosperity of the State cannot be increased unless the agricultural wealth of the country is developed. During the First Five-Year Plan, agriculture was given the most prominent place and the emphasis was on "Grow More Food." During the Second Five-Year Plan emphasis has been laid not only on the Grow More Food but also on increasing the production of every type of crop. The broad aims of the Second Five-Year Plan have been laid down as "increasing the living standards of the people, rapid industrialisation and social justice". If the standard of living of the people is to be raised, it goes without saying that the standard of living of the agriculturists who form 75% of the population is the most vital factor to reckon with. It has been recognised that during the Second Five-Year Plan period enormous sums of money

have to be spent on numerous projects and there is bound to be inflation. To combat this inflation consumers' goods have to be produced. The most important consumer goods that the ordinary man wants are food and clothing. If every man in the village is assured of two square meals a day and is adequately clothed, it can be claimed that the standard of living has been raised. The other necessaries in life are only secondary. The import of other consumer goods, however desirable, has to be restricted if our economy is to be based on a sound foundation.

During the second Five-Year Plan period there is bound to be a gap in the foreign exchange position and this has to be bridged only by the export of agricultural products. While we are aiming at self-suficiency in the matter of food and clothing, we have also to aim at producing a surplus in crops like oilseeds, tobacco, pepper, coffee, tea and rubber. Emphasis has therefore been laid in the second Five-Year Plan period on the diversification of agriculture. Originally the idea was that the target should be raised by 15%, but we are now aiming at an increase of 40%. Plans have been modified accordingly and it is our hope that with the co-operation of the agriculturists in the State we may achieve good results.

In this effort it is very necessary that not only the large landholder and the enlightened agriculturist should take his share, but it is essential to enthuse even the smallest cultivator in the country. Social justice will have no meaning if all the facilities for increasing production are confined to the well-to-do ryots alone. Our main object in all schemes of National Extension and Community Projects is to afford an opportunity to the smaller agriculturists to take their share in the development of the country as a whole. Efforts in this direction have to be intensified. Co-operative aocieties have to be formed in very large numbers, both for financing the agriculture of the small man as well as the marketing of his produce. There is criticism that our efforts in Madras in this direction have not been adequate but I do hope that in the second plan period, this criticism will disappear and that we would march along with the other States in India.

I am very happy to note that in the agenda for the Symposium you have included the subject "Modern trends in Indian Agriculture". There used to be the criticism that agricultural research in India was quite well advanced but there was a gap between agricultural research and agricultural development and that the results of research were not speedily translated into field

practices. I venture to submit that this criticism no longer holds good. Our research workers have succeeded in translating their results into practice very quickly. The sole aim of all agricultural development is maximisation of agricultural production. We can claim that Madras State can show much higher yields per acre in rice, sugarcane, cotton and some of the millets than the other States in India. But in view of the fact that our population is also increasing at a very fast rate, we have got to find ways and means to step up production still higher. It will not be enough to grow two blades of grass where one grew up till now, but it is now necessary to grow even four blades of grass instead of one.

Soil, irrigation and seeds are the three key factors to successful agriculture. Manuring for our crops both under irrigated conditions as well as rainfed conditions present a number of problems. It is very necessary that soil-testing stations should be located in almost every district to determine the nature of the soils and for recommending manurial schedules. Manurial schedules have to be prepared for various conditions, both of soil as well as irrigation. In the same district or even in the same village we come across different types of soils which call for different types of treatment. One of the most important problems to be faced by the modern research worker therefore is testing of soils and offering of advice on the use of suitable manures with proper proportions of N., P_2O_5 & K_2O. We know that by the application of green manures higher yields are made possible. Use of chemical fertilisers also gives increased yield. The use of improved seed increases crop production as also timely transplantation, irrigation and other cultural practices. If supposing increased yield due to green manure is A, that on account of chemical manure is B, on account of improved seed C, on account of improved agricultural practices D, would it be proper to assume that if all these practices are adopted, the increase in production should be A+B+C+D? Obviously agriculture is not simple arithmetic and it is for the scientist to tell us how far this theory will prove true. This is important for testing our achievements against the targets that we have assumed.

The view has been widely held that the proper preparation of the soil is most vital not only for maximisation of production, but also for avoiding pests and diseases. Today there are enlightened agriculturists who feel that the use of chemical fertilisers are responsible for the increase in the incidence of pests and diseases. How far this view can be supported is for the research workers like you to answer. It is no doubt evident that these modern trends

in agricultural production have brought in their train several difficulties also, which call for immediate remedial measures.

In the matter of improved seeds we have to acknowledge the deep debt of gratitude to our Research Stations that have continued to work actively for the past two decades, to produce better strains of paddy, cotton, millets, sugarcane and so on. Local problems like attack of pests in particular areas or the presence of salinity in the soil or the availability of water for short periods of time have all been solved by the evolution of suitable strains of improved seeds. Even a few days saved in the maturing of the crop is a matter of substantial improvement to the agriculturist. Short-term varieties of paddy have played a very important part in the prosperity of the agriculturist and they have enabled him to improve his production by growing two crops where he was able to grow only one before. It has been estimated that in the production of better strains of cotton—the long-staple variety—crores of rupees have been saved for this country by avoiding imports of foreign cotton. The Coimbatore varieties of sugarcane have become famous all over the world. In millets high-yielding strains resistant to disease and strains of short-duration varieties have been evolved. These modern trends have paid ample dividends to the ryots. In combating pests and diseases, agricultural scientists have played a very important part by introducing pesticides and insecticides. But every day fresh problems crop up and it will always be our endeavour to come to the rescue of the agriculturists and give him satisfaction.

Without flattering our agricultural workers I may claim that in this province even the ordinary agriculturist has become modern-minded in agriculture. Even in the remotest village we can hear the ryots talk of our improved strains as Co. 25, Adt. 9, ASD 1 in paddy, Co. 419 in sugarcane, CO 12 and CO 18, cholam in CO 7 in ragi & hybrid cumbu etc. We hear of the Japanese method of paddy cultivation all over the countryside, we see tractor ploughing to bring waste lands under cultivation and electric pumps for lifting water. In many places we see filter point wells and pumping. This shows the co-operation of our agriculturists with the workers both in research and in administrative sections of the agricultural department. More propaganda is needed today for making our agriculturists still more modern-minded and I am sure that the efforts of this department will bear fruit in all directions with the active co-operation of our agriculturists.

Speech of the Minister for Agriculture while inaugurating the 39th College Day and Conference of the Agricultural College and Research Institute, Coimbatore on 7—8—1956

Friends,

I am very happy to be here with you all to-day and participate in the 39th Agricultural College Day ond Conference. The College Day for this institution is different from the College Days of similar institutions in that it is not a mere annual social function but serves more or less as a forum for the free exchange of ideas and experiences between research workers, extension workers, agricultural students and progressive agriculturists and also for dispassionate assessment of the achievments as well as the shortcomings of the Agricultural Department during the previous year. This year's conference is unique because it synchronises with the Golden Jubilee of the Chemistry section.

2. The Chemistry Section is one of the oldest and largest sections in the Research Institute. There has been considerable evpansion in the strength and activities of this section during the last two decades in the various fields of agricultural chemistry such as soil physics, plant nutrition and manures, plant physiology and microbiology. I am aware that this section has built up a good reputation for itself and that the Expert Committee appointed by the Government in 1949 to report on agricultural research in this State bore testimony to the fact that this section has been of considerable service to the public.

3. I am glad that the Golden Jublee celebrations of the chemistry section are to be presided over by Dr. V. Subramaniam, Director of the Central Food Technological Research Institute and Chairman of the Soil Science Committee of the Indian Council of Agricultural Reseasch. He is an eminent agricultural chemist with a national reputation and it is therefore but fitting that he should have been chosen to preside over the Jubilee celebrations.

4. I commend the idea of holding a symposium on " Chemistry in aid of agriculture" as part of the Jubilee celebrations and I hope that during the discussions in this symposium, many valuable suggestions for increasing the usefulness of the chemistry section to the Government and that public will be thrown out. I find that as a permanent memento of the Jubilee celebrations it is proposed to institute a rolling shield to be awarded to the best scientific worker

or research student in the field of agricultural chemistry in the Agricultural Department. I wish the Chemistry section many many more years of useful service.

5. This year the college has started with increased strength. The requirements of the varions development schemes in the Agricultural Sector of the Second Five-Year Plan and the anticipated increased demand from the private sector have made it imperative that the total output of agricultural graduates should be substantially increased. We have therefore increased the admissions from 108 to 162 with effect from this year. I am aware that all the requisite amenities in the shape of additional buildings, etc. consistent with the increase in strength have not yet been provided. But every effort if being made to provide them as early as possible.

6. In this connection I may mention that during the discussions at ihe recent International Labour Organization Conferenc at Geneva which I attended as the leader of the Indian delegation, vocational training in agriculture was a subject on which delegations from European countries showed considerable interest.

7. This year's subject for discussion in the symposium of the Madras Agricultural Students' Union is "Modern Trends in Indian Agriculture". You could not have chosen a better subject considering that we are now in the first year of the Second Five Year Plan under which we have to step up agricultural production to the utmost extent possible. Unless modern trends in agriculture in various parts of the world in which conditions more or less similar to those in our own country are prevailing, are studied and we copy those methods of improved cultivation which have proved very successful elsewhere, we cannot make rapid progress. I may mention as an instance the spectacular results that have been achieved in a remarkable short period by our adoption of the Japanese method of paddy cultivation.

Presidential address delivered by Dr. V. Subramanian, Director, Central Food Technological Research Institute, Mysore, on the occasion of the Golden Jubilee Celebration of the Agricultural Chemistry Section at the Agricultural Research Institute, Coimbatore on 9—8—1956

I consider it quite a privilege to be with you on this historic occasion. Coimbatore has had a succession of brilliant chemists during the past fifty years and by a strange twist of good fortune,

I have met and known every one of them, though, in the case of Dr. Harrison,, I met him for the first time, only at the Pusa Institute in Bihar. Some of your chemists like Drs. Norris and Viswanath and Mr. Shiva Rao I have known quite intimately. Your section at Coimbatore has had a brilliant record of work to its credit and there is practically no branch of agricultural chemistry which it has not touched on, at some time or other.

Agricultural Chemistry is by definition, the branch of of chemistry that deals with everything relating to Agriculture — soils, crops, manures and all allied subjects. Every other branch of Agriculture is dependent on it. From the very early days, Coimbatore had given a valuable lead in several lines, so much so, that several leading scientists and, particularly, both Sir John Russell and Dr Bernard Keen expressed their warm appreciation of the excellent work being done at this important centre.

If we look up the practical developments in agriculture in different parts of the World, we will find that they have occurred in spurts, as influenced by some adverse condition or other. Scientific work may remain merely as publications or even as reports till there develops some situation which necessitates rapid application. We are today applying with considerable benefit, the practical findings of the past 30 or 40 years and in this direction, Coimbatore can be rightly proud of its record.

The mystery of the puddled soil and its relation to the nutrition of the rice plant: Rice is the most important crop to us and to more than half the population of the World. It should be said to the lasting credit of Coimbatore that pioneering work on the mode of decomposition of organic matter in the puddled soil and its bearing on the respiration and nutrition of the rice plant was done at this centre. In fact. Coimbatore has been a leader in the production and application of green manures, both by themselves and in combination with artificials. We know a great deal today, but we are still far from answering the basic query as to what the puddled field gives which the ordinary dry-cultivated land does not provide. I have always held that the apparently extravagant water requirement has a nutritional significance. One constituent in which the rice plant is is richer than most other grain crops, is silicon, which forms a large part of the ash, especially that of the husk. We do not quite know its significance. There may also be other things including some soluble forms of organic matter and certain essential minerals which

are derived from the puddled soil. If only we can unravel this mystery, we would have laid the foundation for a new and possibly revolutionary method of rice cultivaton.

While still on rice, one may refer to another pioneering line started at Coimbatore, viz., the nutritive value of different varieties as influenced by manures, seasons, irrigation, etc. Rice contains a good protein, but the quantity is very small. The over-all nutritive value of the rice diet is very low. It is up to us to develop a variety of rice which even in the raw polished state will contain at least 9 – 10% protein. This can be achieved by the joint efforts of the breeder and the chemist, The Rice Research Institute at Cuttack has already started some work in this line.

The problem of organic manures — Application of plant hormones: Excellent work has been done in regard to the conservation and utilisation of different organic manures. A lot of work on poudrette-making and composting of different wastes has also been done. Some outstanding problems still remain to be covered. One is the control of the decomposition of the organic matter so that the plant benefits to the maximum extent. Because of high temperature and other features, our soils go on decomposing organic matter and we are not able to maintain a sufficiently high level comparable with the soils of Europe and America. We have not also done much in regard to the application of plant hormones. These lines, in which Coimbatore has already done some work, deserve to be pursued and developed.

The utility of providing some soil cover during periods of fallow has exercised the mind of workers in different countries. Our soils are like shallow tanks exposed to the hot sun and they go on losing organic matter whether there is any crop or not. Under almost similar conditions, the soils of Queensland are able to maintain permanent grass. Coimbatore should take a lead in this line of study.

Studies on new fertilisers — Importance of trace elements: During recent years, a large number of new fertilizers have come on the World's market. Some of them have worked well in our hands, while others have presented problems, especially on certain types of soils. There is also the problem of utilising concentrated fertilizers like urea which decompose very quickly. We also have the difficult problem of providing phosphatic fertilizers that will not get lost in our laterite soils. We have to do more work on potash and calcium. The influence of different types of sprays and other methods of

administering essential trace elements deserve to be followed up. We do not know as to how fast our soils are getting depleted.

Importance of animal nutrition: The importance of quality in crops not only in relation to different industrial uses, but also in relation to human and animal nutrition has attracted the attention of several Coimbatore workers. Some of these subjects are now being developed intensely under other auspices, but the link with the Agricultural Chemist is still badly needed. We have to depend to a very large extent, on our cattle, both for our milk and for ploughing and other work in our farms. Agricultural Chemistry and Animal Husbandry should come close together both in collecting and and spreading knowledge. The type of work done by the late P. Venkataramiah desserves to be continued.

Another subject which has been lately much neglected is microbiology in relation to soil fertility and plant nutrition. We should get microbiologists of high calibre who could apply their minds intensively to this problem. Fresh ideas and new developments will come only if there are favourable conditions for work and steady, zealous effort on the part of the workers.

Coimbatore has a tradition for active association with plantation crops on the one hand and horticultural crops on the other. Although these crops are now being sought to be developed under other auspices, it will be for the good of all concerned if the Government sees to it that a proper liaison is maintained.

Best scientists should be attracted to continue in research: Fifty years is a relatively short, though important span, in the history of an institution. A great deal of work still remains ahead of us. If we have to maintain the high reputation and the excellent traditions of the past, the following would deserve very special consideration. Firstly, the posts of Agricultural Chemists and Assistant Agricultura Chemists should be made sufficiently attractive so that the best people will be drawn to them. There should be scope for advancement in the same line, so that people will not be tempted to seek administrative posts. During recent years, there have been several changes and these are not favourable to the continuity of either thought or work. The Research sections should be distinct from the routine branches, and the programmes should be so drawn up that not only practical but also fundamental problems of far-reaching importance will be tackled.

Today, we are reaping the benefits of the efforts of our chemists during the past 50 years. If the succeeding generations are to correspondingly benefit by our present efforts, we should maintain quite high standards and attach special importance to problems of long-range importance. Even one or two findings of significant value will make a tremendous difference to our agricultural economy.

List of Papers Received for the College Day and Conference — 1956.

Symposium on "Modern Trends in Indian Agriculture".

1.	Modern Trends in Indian Agriculture.	Dr. K. C. Naik.
2.	Changing Scenes in Rice Research and Extension.	Bhavani Shankar and P. C. Sahadevan.
3.	Modern Trends in Cotton production and Research in India.	N. Kesava Iyengar.
4.	Modern Trends in Indian Agriculture (Millets and Pulses improvements.)	B. W. X. Ponniah and A. Subramaniam.
5.	Modern Trends in Indian Agriculture with reference to the cultivation of Oil Seeds.	Abdul Samad.
6.	Modern Trends in Fruit Preservation.	Kumari S. Malathi Devi.
7.	Modern Trends in Indian Agriculture, Plant Pathology.	C. V. Govindaswami.
8.	Modern Trends in Indian Agriculture.	C. Balasubramaniam.
9.	Some Modern Trends in Agricultural Teaching, Research and Extension in India.	Dr. S. Krishnamurthy.
10.	The role of land colonisation as a means of Agricultural Development (with special reference to Wynad Land Colonisation Scheme).	K. Fazllula Khan and C. N. Jayasankaran.

11.	Modern Trends in Agriculture, (water use and irrigation problems.)	A. H. S. Sarma.
12.	Modern Trends in Indian Agriculture.	M. J. David.
13.	Modern Trends in Indian Agriculture with special reference to spread of improved strains of Oilseeds.	S. G. Aiyadurai.
14.	Modern Trends in Agriculture Extension Service.	N. Ranganathachari.
15.	Modern Trends in Indian Agriculture.	Dr. A. M. Kulandai.
16.	Modern Trends in Indian Agriculture with reference to potato industry in the Madras State.	M. D. Azariah.
17.	Mechanisation of groundnut cultivation.	V. Subbiah.
18.	Modern Trends in Indian Agriculture with special reference to the control of "Degeneration" of Potatoes on the Nilgiris.	K. Radhakrishna Alwa.
19.	Modern Trends in Indian Agriculture.	R. Govindarajulu.
20.	Modern Trends in Indian Agriculture.	P. K. R. Menon.
21.	Modern Trends in Indian Agriculture "The Pinch in progress and the basic Balm or Panacea".	T. Srinivasan.
22.	Farming and the Scientist.	R. M. Savur.
23.	Modern Trends in Agriculture.	C. L. Sundararajan.

Prizes awarded during the College Day & Conference

Name of the prize	Particulars of the award	Name of the prize winners
	Medal Prizes	
1. The Robertson Prize Medal	For obtaining the highest number of marks in Agriculture in the Final Examination of the University in the B. Sc., (Ag.) and qualifying for the degree at the first appearance.	P. R. Ananda Rao
2. The Clogstoun Prize Medal	For obtaining the highest number of aggregate tatal marks in all the College Terminal Examinations and passing all the University Examinations at the first appearance.	M. Stephen Dorairaj
3. The Kees Prize Medal	For obtaining the highest number of marks in Chemistry of the Final Examinations of B. Sc. (Ag.)	K. P. Rajaram
4. The Dewan Bahadur R. Raghunatha Rao Prize Medal	For obtaining the highest number of marks in practical Agriculture of both College Terminal and University Final Examinations of the B. Sc., (Ag.)	N. Sundaram
5. The D'Silva Memorial Prize Medal	For obtaining the highest number of marks in Animal Hygiene of the University Second Examination of B. Sc., (Ag.)	V. K. Vamadevan

	Name of the prize	Particulars for the award	Name of the Prize winners
6.	The Goschen Prize Medal	For obtaining the highest number of marks in Agricultural Zoology of the University Second Examination of B. Sc., (Ag.)	M. Aravindakshan
7.	The Anstead Prize Medal	For a student who stands first in class II in plot cultivation and passing the First and Second University Examinations at the first attempt.	P. Annamalai
8.	The Rao Bahadur K. S. Venkataramana Iyer Prize Medal	For obtaining the highest number of marks in the aggregate of the First University Examination.	S. Venugopalan
9.	The Sampson Agricultural Botany Prize Medal	For obtaining the highest number of marks in Agricultural Botany of the Final University Examination and qualifying for the degree at the first appearance.	G. Soundarapandian
10.	The Dewan Bahadur L. D. Swamikannu Memorial Prize Medal	For obtaining the highest number of marks in the aggregate in all the three Examinations of B. Sc. (Ag.) and passing the Annual Examination at the first appearance.	M. Stephen Dorairaj
11.	The Food and Agricultural Organisation Prize Medal	For obtaining the highest number of marks at the Second University Examination of B. Sc., (Ag.) at the first appearance.	S. Venugopalan

Name of the prize	Particulars for the award	Name of the Prize winners
12. The Food and Agricultural Organisation Prize Medal	For the best student who obtained the highest number of marks in Agricultural Chemistry in both the College Terminal and University Examination of the Second year B. Sc. (Ag.) put together.	S. R. Sreerangaswami
	Book Prizes	
13. The M. K. Nambiar Prize Book	For the best student who obtained the highest marks at the second B. Sc. (Ag.) Examination held in January 1956 at the first appearance.	K. P. Srinivasan
14. The Gupta Memorial Prize Book	For the best student who secured the highest number of marks in the subject of Agricultural Engineering in the Second Examination of B. Sc., (Ag.) at the first appearance in the subject.	K. Karunakaran

Notes and News

Sports:

The Annual College Day Sports was held on the 9th August 1956. The prizes were given away by Mrs. Nandi, wife of the Wing Commander, Air Force College, Coimbatore. Mr. P. K. Ramachandran Nambiar won the Championship Cup. The following were the prize-winners in the different events :—

1. *Cross-country Race:* (5 miles) (The Norris Cup) (34 minutes 56 sec.)
   (1) S. Rajasekharan. (2) Annamalai. (3) Vijayan Nair.

2. *Pole Vault:* (8 ft. 8 inch.)
   (1) Ganapathy. (2) Ramachandran Nambiar. (3) Gadhadaran.

3. *110 Metres Hurdles:* (The Ramaswami Sivan Cup) (18 - 4/5 sec.)
   (1) Ramachandran Nambiar. (2) K. R. Natarajan. (3) C. V. Ramachandran.

4. *Shot Put:* (33 ft. 11½ inch.)
   (1) Ramachandran Nambiar. (2) Mathias. (3) Perumal.

5. *100 Metres Dash:* (The Saidapet Old Boys' Cup) (12 1/5 sec.)
   (1) S. Pitchai. (2) Ramachandran Nambiar. (3) Rajasekharan.

6. *Long Jump:* (18 ft. 8 inch.)
   (1) S. Pitchai. (2) Ramachandran Nambiar. (3) Muthu)

7. *Discus Throw:* (91 ft. 9½ inch.)
   (1) Ramachandran Nambiar. (2) Perumal. (3) Varadhan.

8. *200 Metres Hurdles:* (30 1/5 sec.) (Naganna Gowd Cup.)
   (1) Natarajan. (2) Muthu. (3) C. V. Ramachandran.

9. *High Jump:* (4 ft. 11¾ inch.) (The Tadulingam Cup.)
   (1) Jagadesan. (2) Ramachandran Nambiar. (3) Vijayan Nair.

10. *200 Metres Race:* (26 sec.)
    (1) Ramachandran Nambiar. (2) Muthu. (3) S. Pitchai.

11. *Invitation Race:* (800 Metres.)
    (1) Joseph Varkey, P. S. G. College. (2) K. Arumugam, (St. Michaels High School.) (3) M. Palaniswami, (North Coimbatore Municipal High School.)

12. *Hop:Step, and Jump:* (37 ft. 4¾ inch.)
    (1) Pitchai. (2) Muthu. (3) K. Ramaswami.

13. *Old Boys Competition:*
    (1) S. Varadarajan. (2) G. V. Ramanan. (3) K. Varadachari.

14. *400 Metres Race:* (The Prince of Wales Cup.) (58 - 1/5)
    (1) K. R. Natarajan. (2) Rajasekharan. (3) S. Pitchai.

15. *Javelin Throw:* (143 ft. 1½ inch.)
    (1) K. Ramaswami. (2) Ramachandra Nambiar. (3) M. J. Tom.

16. *Staff Race for Men:* (100 Yards Dash.)
    (1) K. C. Chandy. (2) S. Varadarajan. (3) G. V. Ramanan.

17. *1500 Metres Race:* (4 - 52 sec.)
    (1) V. Muthu. (2) Annamalai. (3) Vijayan Nair.

18. *Hammer Throw:* (73 ft. 9 inch.)
    (1) Ramachandran Nambiar. (2) K. R. Natarajan. (3) Perumal.

19. *Obstacle Race:*
    (1) T. S. Theetharappan. (2) K. Nellaiappan. (3) K. S. Sundaresan.

20. *Lime and Spoon Race for Women:*
    (1) Mrs. Samathuvam. (2) Hemalatha. (3) Vijayalakshmi.

21. *Musical Chair for Women:*
    (1) Rani Victor. (2) Mrs. Samathuvam. (3) Mrs. Gonsalves.

Proceedings of the General Body Meeting held on 10-8-1956

The Annual General Body Meeting of the Madras Agricultural Students' Union was held this year at 9 A. M. on 10—8—1956 at the Freeman Hall of the Agricultural College, with Dr. R. C. Naik in the chair.

120 Members were present for the meeting. The Minutes of the General Body Meeting held on 18—8—1955, the Audit Report for 1955—'56, and the Budget Estimates for 1956—'57 were read and adopted. The following were decided upon.

(1) To conduct a benefit performance to enhance the resources of the Madras Agricultural Students' Union.

(2) To change the name of the Madras Agricultural Students' Union to "Madras Agricultural Union". This was proposed and carried unanimously.

The following office - bearers were elected for 1956 — '57

Dr. K. C. Naik, President, (Ex-Officio)
Sri T. R. Narayanan, Resident Vice-President
,, A. H. S Sarma, Editor
,, John Dorairaj, Secretary

Moffusil Vice-Presidents

C. R. Seshadri, (Head-quarters, Deputy Director of Agriculture), (Research)
Mohamad Ali, Deputy Director of Agriculture, Tanjore
T. S. Francis, Deputy Director ot Agriculture, Madurai

Moffusil Members

M. J. David, District Agricultural Officer, Pattukottai
K. Saptharishi, Superintendent, Agricultural Research Station, Nanjanad
V. Srinivasan, Superintendent, Agricultual Research Station, Aduthurai
K. Meenakshisundaram, District Agricultural Officer, Chingleput
P. Krishnaswami, Superintendent, Agricultural Research Station, Tindivanam

Resident Members

K. Varadachari, Deputy Director of Agriculture, Coimbatore
S. Ramaswamy, District Agricultural Officer, Coimbatore
V. Rajaguru, (Club Secretary)

Managing Committee (10 Members)

Resident Vice-President
Editor
Secretary
D. Meenakshisundaram, (Manager)
M. V. Sukanya Bai, (Treasurer)
J. Sankaram Rao, Member
K. Rajagopal ,,
K. S. Shetty ,,
Perumal Raja, Student, II year Class Representative
V. Rajaguru, Secretary, Students' Club (Ex-Officio

Editorial Board

Editor
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C. Balasubramania Mudaliar, Member
S. Varadarajan ,,
P. C. Sahadevan ,,
G. Ramanathan, (Student) ,,
V. Rajaguru, Secretary, Students' Club (Ex-Officio)

Rice in Coorg

by

C. K. SUBRAMANIAM

(Micronutrient Research Station, Gonicoppal P. O., Coorg)

Rice *(Oryza sativa)* is one of the earliest crops to come under cultivation in Coorg. The time-honoured religious festival *Huthri*, celebrating the harvest of paddy gives some indication as to the great antiquity of this cereal here. From olden times each family has been assigned a block of unalienable paddy land and the agricultural economy is closely linked with various aspects of paddy cultivation.

Area: Rice covers about fifty percent of the cultivated area today. There has been a small but steady increase in area, from 66, 896 acres in 1870 to 92, 778 acres in 1953.

Climate: Coorg is a hilly country perched on the Western Ghats between 11° 56' and 12° 50' North longitude and 75° 22' and 76° 12' East latitude receiving the benefit of the South-West monsoon and a fair quantity of the North-East monsoon. The annual rainfall varies from about 40 inches in the eastern border to nearly 200 inches on the western zone. The heaviest rainfall recorded is 386 inches in Bhagamandala in 1924 and the lowest in Fraserpet, 29 inches in 1918. Throughout the growing season the atmosphere is quite humid and the temperature ranges from 40°F to 92°F. Rice thrives well in all zones, but in the colder places the same variety takes a longer time to come to maturity. Drought conditions are sometimes experienced due to failure of rains. No frosts have been reported.

Season: Only one crop is raised in most places, from July to January and a second crop is grown between November and March wherever there is enough water supply, especially in Sampaje and a few valleys in North Coorg. Dry paddy or *Bithne* as it is called, is sown behind the plough in April and harvested in October in some parts in the north-eastern zone. Although a second crop of rice is a distinct possibility in many places, this has not come into vogue due to cattle trespass and the fear of thunderstorms in March-April, when the crop would be ready for harvest.

Water: Rice needs an abundant supply of water and it is the major factor in determining the variety and the season

for the crop. The water requirement of paddy is estimated at 23,000 gallons of water per acre and it needs a constantly changing supply of water throughout its growth. The major area of rice falls under purely rainfed conditions. About 2,500 acres are irrigable during the final stages, if the monsoon fails. While the uplands have to depend purely on rainfall the lowlands get the benefit of the seepage water and the innumerable springs. In spite of the high rainfall which sometimes cause damage to the crop as well as to the fields, there are instances where crops have failed for want of water during the maturing period. Although light, the North-East monsoon is decisive of yields. Coorg presents special problems in planning out irrigation schemes. Storing the rain and and seepage water in small tanks and reservoirs adjoining the fields and pumping it out during the scarcity periods is feasible. An attempt at utilising the ground water in the valleys where the water table is high during the summer for raising a second crop needs further investigation.

Drainage: Drainage is as important as irrigation and there is evidence that improper drainage has led to reduced yields in some areas. Notably a vast fertile tract in Begur Collie gets submerged with water till October. Transplanting is considerably delayed and even then is quite hazardous. Providing efficient drainage may be very expensive but possibilities of introducing flood-tolerant varieties need consideration.

Soil: Rice is usually grown in the valleys which are of considerable breadth and some miles in length in South Coorg and rather small and narrow in North Coorg. The lower broader fields and called *bailu gadde*, while those terraced up along the slopes depending chiefly on the rainfall are called *mani gadde.* Rice is grown at altitudes from 1,000 to 4,900 feet above mean sea level.

The soil in Coorg has been formed by the weathering of the metamorphic rocks and in the valleys it is usually a lateritic debris very deep and easily drained. The top ploughed layer is usually sandy loam, greyish-white in colour. In the lower depths the profile is a heterogenous mixture of reddish and greyish sandy loam and clay with concretions of iron and manganese. Mica, felspar and quartz are found in varying proportions. An yield survey has indicated high fertility on the river banks. The remaining area is intrinsically poor. But during the monsoon the fields receive the decomposition products of the neighbouring forests and the leached

nutrients from the slopes, which probably account for the good yields.

The results of analysis of two typical samples of the plough layer from paddy fields are given below:

		Gowdhalli	*Kalkeri*
		%	%
Loss on irrigation	...	8·31	5·50
Insolubles	...	83·54	92·85
Iron and alumina	...	6·36	1·63
Lime	...	0·08	0·08
Potash	...	0·52	0·12
Phosphoric acid	...	0·20	0·16
Available phosphoric acid	...	0·07	0·009
Available potash	...	0·08	0·03
Nitrogen	...	0·12	0·20
pH	...	6.5	5·8

There would also appear to be some zonal differences, perhaps due to the climatic conditions and environments. The soils of Napoklu and Merkara nads in the heavy rainfall zone are highly leached and show remarkable absence of lime. Soils of Virajpet and Somwarpet are more fertile and have a comparatively better texture. Soil of Ponnampet are sandy with patches of waterlogged areas. In the Fraserpet zone receiving lower rainfall, there is a certain amount of calcium in the soils which are mostly clayey. Because of the constant leaching they are all deficient in exchangeable bases and available nutrients.

Varieties: There are said to be more than 50 varieties popular here. The important among them are listed below:

		Estimated acreage	*Duration in days*
Kirbiliya	...	30,500	165
Kiggatbiliya	...	18,000	165
Mambiliya	...	18,400	165
Doddabiliya	...	4,900	175
Doddi	...	4,800	145
Chendubiliya	...	3,700	175
Sannabatha	...	3,100	145
Kembatti	...	1,400	145
Kesakki	...	1,400	175
Kajebiliya	...	1,100	175
Ponnabatha	...	1,000	135

		Estimated acreage	*Duration in days*
Andrewsail	...	900	145
GEB 24	..	500	155
Kaima	...	300	175
Kesari	...	200	110
Kavadedoddi	...	100	135

(Among these *Andrewsail* GEB 24 are exotic varieties, *Kembatti* has red grains and *Sannabatha* is a fine variety.)

Some of the other varieties which are grown in smaller areas are: Deddakaima, Bonka, Kolikododdere, Jeerigesanna, Gandasale, Haribatta, Valubatha, Haludoddi, Rajakaima, Minegekesary, Karisanna, Honnesoge, Honnesinghe, Anekesari, Hasade, Kartha, Pandikartha, Porikolame, Kalme Halubiliya, Harangi, Mulla, Mothepugge, Athikraya, Bilakki, Kolikedoddi, Munikesari, Puttubatha, etc.

At the Rice Breeding Station, Ponnampet, a search for better quality rice with higher yields is being made.

Cultivation: *Seeds:* Usually a heavily manured plot is earmarked for seed paddy and the produce from that plot is harvested and thrashed separately. The harvested sheaves are left exposed to the sun and dew for three nights and three days and then thrashed and winnowed and the seed is packed in a straw basket and kept dry along with the other produce. Some growers soak it in water before sowing to separate the lighter ones. The good seeds are kept moist for three days and after germination are sown in the nurseries. But when the seed is drilled it is sown at the rate of 60-100 lb. per acre before germination. Soaking the seed in salt water to ensure well-filled and heavy grains and treating them with a fungicide is becoming increasingly popular nowadays.

Nursery: About ten cents of land for every acre of transplanted paddy is ploughed six times and about 2-3-tons of farmyard manure or compost are applied evenly on it. The field is puddled well and about 60-100 lb. of seed is sown after letting out all the water so that the seed is just embedded in the soft mud. After about 20-30 days when the seedlings have attained a height of about a foot the plants are ready for transplanting. However, progressive farmers sow 15-20 lb. seeds thinly in narrow seedbeds and manure them heavily to give sturdy seedlings to transplant an acre. Some damage occurs due to insects and diseases in the nursery stage, but these are effectively controlled.

Preparation of the field and transplanting: On a propitious day, *Vishnu Sankramana* in April, ploughing is commenced with religious rites. Ploughing is done six times, two in the dry stage and the rest in the wet condition. Ploughing is usually done between 6 and 10 in the morning and it normally takes a pair of bullocks three days to cover an acre. Ploughing after harvest and before April is tabooed on religious grounds. But ploughing the land after harvest would increase the yields. Farmyard manure is transported and stored in heaps and protected against the sun in summer months and spread and incorporated at the wet ploughing stage. About 2-3 tons of farmyard manure or compost and about 2000 lb. of green leaves are applied per acre by the majority of the people. In certain areas in South Coorg where the holdings are rather large, the preparatory cultivation is not so thorough and the use of a rotavator could be seriously considered. The seedlings are transplanted in July - August, 5-20 per hole, 9-12 inches apart. Seedlings are pulled out by womenfolk and tied up in handy bundles and are deposited conveniently all over the field. Transplanting is done by men, usually the owners themselves with the help of neighbours and hired labourers. While transplanting, the rows are kept straight and the distance between rows fairly uniform. About seven women can pull out enough seedlings in an afternoon to transplant an acre by seven men on the following day. Seedlings are planted closer in a poor soil and further apart in a richer soil. In areas subject to floods more seedlings are planted per hole. Weeding is done only once, four weeks after transplanting. It is recommended that robust seedlings are planted only one or two per hole and weeding done more frequently to give increased yields.

Manuring: As already stated the fields get only a small amount of farmyard manure and green leaves. This is largely due to the fact that most of the fields yield enough produce for the consumption of the owner who also invariably possesses some plantation crop which gives more net profit per acre than rice. A combination of ammonium sulphate and groundnut cake with superphosphate or bonemeal to give upto 40 lb. Nitrogen and 40 lb. Phosphoric acid per acre has been found to give increased profitable yields by the growers. Good response to lime applications has also been noticed in the central zone running north to south. There has not been any evidence so far of response to potash.

In calloboration with the Indian Council of Agricultural Research and the Indian Agricultural Research Institute, the State

Department of Agriculture is conducting a systematic soil survey and simple manurial experiments in ryots' holdings and complex experiments in the farms to evolve a manuring scheme for the dfferent zones.

Pests: *Stem borer (Schoenobius incertellus):* The adults are nocturnal and therefore a light trap may be found useful. Clipping off leafblades to remove eggs which have bren deposited already and dipping the seedlings in 0·2 percent BHC at the time of transplanting will reduce the damage. In later stages spraying with DDT minimises the loss. The pest is severe only in the Sampaje zone. *Hairy Caterpiller (Nisaga simplex)* is serious in the terraced fields of the high rainfall areas of Mercara zone. DDT sprays repeated fortnightly controls the pest. The bunds should be trimmed to destroy eggs laid on them. *Hispa (Hispa armigera)* is a serious pest in the northern parts of the State. Dusting with BHC has been found to be effective in controlling this pest. *Leptispa (Leptispa pygmoea):* Maximum incidence of this pest is found in the early stages of rice growth and is severe in the drilled areas in North Coorg. Dusting with BHC has been found to be good. *Gall Fly (Pachydiplosis oryzea)* is not a serious pest in Coorg although it is found here and there. *Rice Case Worm (Nymphula depunctalis)* causes severe damage in the heavy rainfall zones of the State and are controlled by spraying with BHC. Gunnies dipped in kerosene is placed at the mouth of irrigation drains so that a thin film of oil is spread over the standing water in the field and a long pole held at the ends by two men is run over the standing crop causing the cases to dislodge and fall down where they are killed. *Rice Bug (Leptocorisa acuta)* is severe only in Sampaje zone and is effectively controlled by dusting with BHC. *Grasshopper (Hieroglyphus banian)* is also a serious pest in the Sampaje zone and dusting with BHC is helpful.

Diseases: *Piricularia oryzae. Helminthosporium oryzae. Sclerotium oryzae* and *Ephalis oryzae* have been identified to cause damage to the rice crop but the damage due to the last three diseases is negligible. *Piricularia* or 'blast' is sometimes severe in the very humid areas and in fertile fields or those which receive a unusually heavy dose of chemical nitrogenous fertiliser. All varieties seem to be susceptible to this disease. Neck infection causes complete loss of crop. In the early stages spraying with Bordeaux mixture has been useful.

Implements: The agricultural implements are very few and quite ancient. The plough consists of a wooden ploughshare with a iron point *(gula)*, a handle of pali wood, a pole of sago palm or bamboo for the yoke. It is light and can be easily carried on the shoulder. This does not plough deep but is popular because the weak cattle that exist here can pull it easily. Another implement is the *tawe* or harrow which is only a simple board to which a thin bamboo is attached to connect it with the yoke. The cultivator stands on the board to level the wetland or pulverise the dry land after ploughing. A *mammuti* or hoe is used for trimming the bunds and a small sickle with or without a serrated edge is used for harvesting. A seed drill 4–6 tyned called *Kurige* and a single furrowed one, *Sadde*, is also popular in North Coorg. The iron plough, the puddler, the Japanese intercultivator and a hand-thresher are being popularised now.

Harvesting: The paddy is ready for harvest in November-December when a seven-day harvest festival *Huthri* is celebrated to bring in new rice, *pudiari*. The water is drained off the fields and the plants are cut close to the ground and left on the spot for 5 or 6 days. They are then tied up in sheaves and carried to the threshing floor and stacked with earheads inwards in a circular heap. Absut 7–8 labourers (men and women) can harvest an acre in a day. A month or two later the sheaves are spread on the ground with panicles topmost around a pole and are beaten with a pole and trampled by bullocks or buffaloes. The grain is winnowed and stored in large wooden attics or bamboo bins.

Some damage occurs due to rains during harvest and sometimes due to lodging of the crop.

Production and Utilisation: The total estimated production of paddy is about 75,000 tons of paddy or 50,000 tons of clean rice, out of which 13,000 tons get exported to Malabar and Travancore-Cochin and about 7,000 tons to Mysore. About three to four thousand tons are reserved for seed purposes. About 4000-5000 tons are sold in the internal markets while the rest is consumed by the cultivators and labourers. Some quantity is of course, lost in storage and shrinkage and some consumed by dogs and other pets. Rats and other pests do some damage to the stored grain.

Rice is the staple food of the people here. Parboiled rice is used to a limited extent only. A very small quantity is made into

beaten rice *(avalakki)*. The straw is mainly used as cattlefeed and for thatching dwellings. The straw does not possess sufficient strength for making into baskets, hats, etc.

Paddy is husked by wooden pestle and mortar or by *Rate*, which yields a higher percentage of broken grains. There are 19 rice mills which dehusk paddy. The husk is used as a fuel in the mills and the burnt ash as manure for paddy fields. The bran is used as cattle and poultry feed.

Acknowledgements: Grateful acknowledgements are due to Sri B. S. Varadarajan, B. Ag., Agricultural Officer, Coorg, for his valuable and helpful criticisms. Thanks are also due to my colleagues in the department and the rice growers who willingly gave useful information. I am indebted to Dr. K. M. Aiyappa, M. Sc., Ph. D., Horticulturist, Coorg, for reviewing the manuscript.

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A review of some Recent at the Agricultural Manurial Trials on Potatoes Research Station, Nanjanad.

Optimum requirements of Nitrogen and Phosphoric Acid: Ten bags of commercial fertiliser mixtures (2,000 lb.), of the value of nearly Rs. 350/-, are normally required to raise an acre of potatoes on the the Nilgiris. These are mainly based on the formula of the Nanjanad Mixture, evolved as a result of studies at the Agricultural Research Station, Nanjanad, as the most suitable for optimum and economic yields. The composition and the chemical analysis of the Nanjanad Mixture are as follows:

Ingredients per acre. Name	Quantity. in lb.	Containing lb. of N	P_2O_5	K_2O	Analysing to (%)
1. Groundnut cake meal	500	35	..	..	
2. Bonemeal	350	10	80	..	N = 4·37
3. Ammonium sulphate	200	40	..	..	P_2O_5 = 11·00
4. Superphosphate	672	..	134	..	K_2O = 5·55
5. Potassium sulphate	224	...	..	108	
	1946	85	214	108	

Russell and Garner (2) have recommended three to four cwt. of ammonium sulphate for normal nitrogenous manuring, and less than three cwt. for light and up to four cwt. for heavy soils, of superphosphate. They also considered two cwt. of potassium sulphate as a normal level. Smith (4) reported that the yields, resulting from an application of 2400 lb. of a 5–10–10 fertiliser mixture, averaged 52 bushels more per acre than the 1,200 lb. application. Hoagland (1) found that, although the maximum gross returns were reached at 2000 lb., maximum net returns beyond the cost of the fertilisers were reached at between 1,500 lb. and 1,800 lb. per acre. Fertiliser studies with potatoes by Sanyasi Raju *et al*, (3) at the Agricultural Research Station, Nanjanad, during 1949–51, led to the conclusion that the Nanjanad Mixture contained the minimum of ingredients necessary for good yields of potatoes on the Nilgiri Hills and that no further reduction in either the nitrogen or phosphoric acid content seemed possible.

In the trial now reported, and which was run on a replicated basis in the main crops of 1953 and 1954, a total of 24 combinations, consisting of four levels of nitrogen as ammonium sulphate

(at 60, 80, 100 and 120 lb. of nitrogen per acre), permuted with six levels of phosphoric acid as superphosphate (30, 60, 120, 180, 200 and 240 lb. of phosphoric acid per acre), was employed; potash being kept unvaried at 224 lb. of potassium sulphate, as in the Nanjanad Mixture. The 'Control' for the above 24 treatments was the usual Nanjanad Mixture.

Statistical examination of the yield data revealed that, though the combinations of (1) 10 lb. N + 240 lb. P_2O_5 and (2) 120 lb. N + 240 lb P_2O_5 had recorded the maximum yields for the years 1953 and 1954 respectively, they were not significantly higher than the values returned by the Control (Nanjanad Mixture). The results, therefore, were in accord with the earlier trials on manuring, reported by the Government Agricultural Chemist, Coimbatore (3).

Effects of different carriers of phosphoric acid: During the years 1951 and 1952, trials were conducted at the Agricultural Research Station, Nanjanad, to study the beneficial effects, if any, of replacing the superphosphate content of the Nanjanad Mixture with (1) fused phosphate and (2) a semi-acidulated rock phosphate (Kotka phosphate, processed by Parry & Co., Ltd., Madras), to see if these two would prove more acceptable to the potato crop in the acid soils of the Nilgiris. Fused phosphate analysed to 22·22% P_2O_5, while Kotka phosphate contained 25·43%.

The yield values of the replicated trials were examined and resulted in the following conclusions:

(1) *Fused phosphate:* Tried over two seasons (the main and the second crops of 1951). Treatment effects on yields were not significant;

(2) *Kotka phosphate:* Run in the second crop of 1953. No increase in yields was evident on the replacement of superphosphate by Kotka phosphate.

All the trials, reported above, were designed by the Government Agricultural Chemist, Coimbatore, to whom the writers' thanks are due.

Agricultural Research Station, Nanjanad.

M. D. AZARIAH,
K. SAPTHARISHI.

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Book Reviews

1. *The work of F. A. O. 1954–'55. (Orient Longmans Ltd., Madras,) Price: 5 shillings.*

One of the heartening signs in the present day unquiet world is the solid achievement of the Food and Agriculture Organisation of the United Nations. The present reports gives a very clear account of the problems met and work accomplished during 1954–'55 and seems to indicate the growing integration of the advisory services with the existing fundamental programmes. As an additional aspect in the activities of the F. A. O. comes the expanded Technical Assistance Programme and in this, the need is all the more pressing for the closest integration of programmes within the country that receives technical assistance.

Starting with an introductory preamble on its nature and purpose, the Report given a lucid summary of work done on (1) Agriculture, including agricultural instruction and services, rural welfare, land and water use, plant and animal production. The next deals with into economics followed by fisheries, forestry and nutrition. The final two sections deal with fnformational and educational services, and administrative and financial developments.

2. *The State of Food and Agriculture 1955. (Review of a decade and outlook) (Orient Longmans Ltd., Madras. Price. 12 sh. 6 d).*

This publication conforms to the high standard we have now come to expect in all F. A, O. publications, both in regard to the subject matter, presentation and general get-up. It marks the tenth anniversary of the foundation of the

F. A. O. These ten years have been crowded with events of great significance and witnessed the transformation from the devastation and threat of famine of the postwar period to a stage where agricultural surpluses are once more causing concern in some countries of the world. This decade has also seen rapid advances in the technical methods adopted in agriculture, forestry and fisheries. As mentioned in the foreword by the Director General, the report aims at a critical analysis of the main postwar developments and an appraisal of the results achieved, together with a survey of the problems that still remain to the tackled.

3. **Common Cultivated Crops of South India:** *by V. T. Subbiah Mudaliar. (Published by the Amudha Nilayam (Private) Ltd., 91 Mount Road, Madras. (Rs. 15/-) 1955.*

This book is a very welcome addition to the not-so-numerous group of handbooks on Indian Agriculture and is bound to serve a real need for all those who desire to know something about our South Indian crops. The author has had the advantage of a long and close association with agricultural research and education and he has utilised it to the full in the preparation of this useful compendium of information on the field crops of South India. The book is bound to be very helpful to teachers of agricultural subjects in secondary schools as well as the staff employed in the National Extension Service and Community Project areas.

Other books received are:

Agriculture in the World Economy F. A. O. Rome. November, 1955.

Report of the third Special Meeting on the Economic Aspects of the Rice Industry - Bangkok (F. A. O. Rome. 1955. (Orient Longmans Ltd., Madras).

Students' Club News

Under the auspices of the Students' Club, an address on "Agriculture in Australia" was delivered on 27—7—1956 by Dr. Siddappa, Senior Scientific Officer, Central Food Technology Research Institute, Mysore. Dr. K. C. Naik, the Principal and President of the Students' Club, presided over the function.

Dr. Siddappa, during the course of his address said that Agro-Horticultural industries had made tremendous headway in Australia. Working mainly on a co-operative basis this industry had been taken up in an intensive manner and the country has achieved remarkable progress. One striking feature of these industries, he said, was that the people of Australia were able to produce finished goods at a very much cheaper rate, although labour charges are comparatively high. This, he pointed out, was mainly to the business line being carried on a co-operative basis. The success of these industries was due not to chance but to the rigid application of their research findings, which enabled them to hit the mark every time. Continuing his speech, the speaker described the various

outstanding industries of the country such as the sugarcane industry, grapevine industry, milk industry and so on. The country stands on its own legs for everything, including the manufacture of processing equipments. At the close of his speech, Dr. Siddappa, said how the maximam wage given to superior officers did not differ very much from the minimum wages, paid to labourers. In the end the students and the officers put a number of questions relating to the subject "Agriculture in Australia", to all of which Dr. Siddappa gave very informative replies.

The vote of thanks at the close of the function was proposed by Sri V. Rajaguru, the acting Club Secretary, after the President's concluding remarks.

* * *

This year, the Madras Agricultural Students' Union had decided to have an essay or debating contest for the students, the prize for which will be awarded to the winners on the College Day and Conference. In accordance with this, a debating contest was arranged on 2nd August 1956, the subject being 'Agriculture rather than Industry'. This debate was open to all the students of the College. Among several speakers, Mr. S. Lakshminarayan of the final year class, who spoke for the motion, got the first ranking by the judges and Mr. G. Ramanathan of the final year class who spoke against the motion, got the second prize.

Dr. K. C. Naik presided over the function. In addition to Dr. K. C. Naik, Mrs. Gonsalves and Dr. K. Subramaniam, Regional Botanist, Botanical Survey of India, also acted as judges. The vote of thanks was propssed by Sri V. Rajaguru at the close of the function.

* * *

A meeting of the Managing Committee of the Students' Club was held on 14—8—1956 with Dr. K. C. Naik in the chair. The Vice-President announced that the following members are nominated for the posts noted against their names.

Mr. C. Gopal – Secretary, Debating Society.
Mr. Khalil Ahmed – II year class representative.
Mr. Moosad – I year class representative.

It was decided that a rolling cup donated by Sri Piyasena would be awarded to the best student photographer. The Committee has also decided to increase the pay of the Club Boy by two rupees per month.

(G. RAMANATHAN)

Weather Review — For July, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	4·0	+ 0·4	12·1
	Tirurkuppam*	3·8	— 0·8	9·8
	Vellore	4 2	— 0·4	15·9
	Gudiyatham*	3·3	— 1·3	10·4
East Coast	Palur*	1·7	— 1·1	11·7
	Tindivanam*	1·2	— 2·4	9·1
	Cuddalore	1·5	— 1·1	9·3
	Nagapattinam	3·1	+ 1·4	7·8
	Aduthurai*	1·7	— 0·6	8·6
	Pattukottai*	1·1	— 2·6	8·2
Central	Salem	3·5	— 0·3	10·3
	Coimbatore (A. M. O.)*	1·6	— 0·4	7·9
	Coimbatore	1·0	— 0·7	6·5
	Tiruchirapalli	Nil	— 1·1	3·9

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
South	Madurai	0·2	— 1·8	6·2
	Pamban	0·2	— 0·3	2·2
	Koilpatti*	0·1	— 0·6	7·1
	Palayamcottai	0.1	— 0·2	4·4
	Ambasamudram*	0·6	— 0·2	7·0
West Coast	Trivandrum*	4·3	— 3·5	29·1
	Fort Cochin	11·1	—12·2	83·3
	Pattambi*	13·7	— 9·6	56·5
	Kozhikode	19·0	—15 3	85·5
	Taliparamba*	30·3	—14·1	93·1
	Wynaad*	15·4	— 5·5	50·3
	Nileshwar*			77·4
	Pilicode*	25·1	—18·0	88·1
	Mangalore	38·6	— 0·8	105·1
	Kankanady*	41·4	— 1·2	108·4
	Kotekar*	38·1	— 4·4	£
Hills	Kodaikanal	0·9	— 3·8	18·1
	Coonoor*	1·1	— 2·0	12·8
	Ootacamund*	3·1	— 3·1	18·7
	Nanjanad*	7·5	— 3·1	24·0

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.
2. £ = It is a new station. The raingauge was installed in March 1956.

In the first two days of the month the monsoon was vigorous on tne West Coast and fairly active elsewhere in the region. For four days from 3—7—1956 the monsoon was fairly active in the West Coast but elsewhere the weather was mainly dry. A well-marked low appeared over Gangetic West Bengal and neighbourhood on 7—7—56. The rainfall was fairly widespread in Malabar and South Kanara and localised and scattered in Travancore-Cochin and portions of Tamilnad for five days from 7—7—56. On 12—7—56 only the West Coast had widespread rains while the weather was dry in other parts of the State. Even in the West Coast the vigour of the monsoon abated considerably on 13—7—56. Only scattered showers were received on the West Coast on 13—7—56 and in the subsequent two days while Travancore-Cochin and a few places in Tamilnad received only mild showers during this period. The weather was mainly dry on 16—7—56. The Arabian Sea branch of the monsoon became weak on 17—7—56. For two days from 17—7—56 localised showers were received on the West Coast while other regions had very mild showers. On 19—7—56 the Arabian Sea branch of the monsoon became active with the result that for five days from this day rains were fairly widespread in the West Coast and scattered and localised elsewhere. The monsoon was inactive on 24—7—56 with the result that for five days from this day

only a few places in the West Coast had fairly widespread rains while the showers were highly localised elsewhere. In the remaining three days of the month rains were fairly widespread in Malabar and South Kanara and localised in Travancore-Cochin, while the weather was mainly dry in Tamilnad. The month ended with a favourable condition for the formation of a depression in the Bay of Bengal.

Considering the month as a whole the West Coast and hilly regions had poor rains. The other districts also had only sub-normal rains with the exception of Madras (Meenambakkam) and Nagapattinam area of Tanjore district.

The noteworthy rainfall and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			**Zonal Rainfall**			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
1/7/56	Mangalore	6·0	North	3·8	—1·9	Below normal
1/7/56	Kozhikode	5·0	East Coast	1·7	—1·1	do
2/7/56 & 21/7/56	Mercara (Each day)	4·0	Central	1·5	—0·6	do
			South	0·2	—0·6	Far below normal
20/7/56	Palghat	2·0	West Coast			Below normal
27/6/56	Mercara	5·0	Hills	3·2	—3·0	do

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 14—8—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Service — Postings and Transfers.

Name and present post	Posted as
Mrs. Girija Balasubramaniam, Assistant in Botany, Coimbatore,	Fodder Research Officer, Coimbatore.
Krishnan, C. S., Assistant Cotton Specialist,	Gazetted Assistant to Cotton Certification Officer, Rajapalayam.
Narayanan, N. G., Gazetted Assistant to Certification Officer, Rajapalayam,	Cotton Certification Officer, Rajapalayam.
Ranganathachari, N., (on leave)	Additional Lecturer in Agronomy, Coimbatore.
Sakharam Rao, J., Assistant Lecturer in Botany, Coimbatore,	Additional Lecturer in Botany, Agricultural College.
Thandayutham, K., Agricultural Engineering Supervisor, under training at Ooty,	Assistant Agricultural Engineer, Soil Conservation Scheme, Gudalur.

UPPER SUBORDINATES

Name and present post	Posted as
Ananthachari, P. S., P. A., to D. A. O., Vellore,	Special A. D., Vellore.
Ananda Rao, P. R., Dharmapuri,	A. D., Sangaree.
Alfred William, Trainee at Ooty,	Under D. A. O., Salem.
Bhaskharan, A. R., Trainee at Ooty,	Soil Conservation Assistant, Coonoor.
Bhagavathiappan, N., Nagercoil,	A. D., Peralam.
Bhanu, K., Coimbatore,	A. D., Kumarakshi, (Chidambaram).
Balasubramaniam, V., Kanal,	A. D., Kuttalam.
Balakrishnan, R., Pappanaickanpudur,	Chemistry Assistant, Coimbatore.
Chelliah, P., Keelapatnam,	A. D., Tuticorin.
Chockalingam, M., Trainee at Ooty,	Soil Conservation Assistant, Coimbatore.
Dhanapalan, M. S., K. S. A., Sivakasi,	Assistant in Chemistry, Coimbatore.
Gnanavaram, I., Trainee at Ooty,	Soil Conservation Assistant, Dharapuram
Hariharan, S. V., Trainee at Ooty,	Soil Conservation Assistant, Vellore.
Hydross, S., Palayamkottai,	A. D., Vaniambadi.
Haja Sherrif, Edayakottai,	A. D., Aiyampalayam.
Jesudasan, K. M., Nanguneri,	Entomology Assistant, Udangudi.
Krishnamurthy, F. M., Bhavanisagar,	A. D., Gudiyattam.

Name and present post	Posted as
Kothandaraman, G. V., Annasagaram,	Oil Seed Assistant, Tindivanam.
Kandaswami, P., Coimbatore,	Oil Seed Assistant, Pollachi.
Krishnankutty Nair, Trainee at Ooty,	Agricultural Engineering Supervisor, under D. A. O., Kozhikode.
Krishna Rao, R., Trainee at Ooty,	Soil Conservation Assistant, Vellore.
Lakshmanan, P. K., Sivakasi,	A. D., Reddiapatty. (Ramnad).
Mahalingam, N., Tirukoilur,	A. D., Sankarapuram.
Murugian, S. K., Mewani,	A. D., Pernambur.
Marappan, K., Maruppatti,	A. D., Salem.
Muthu Mangiah Muthiah, Edayakottai,	A. D., Sithalai.
Muthumani, P., Mukudal,	A. D., Chetpet.
Muthiah, A. D., Tirunelvelly,	Instructor in Agriculture, Coimbatore.
Morachan, Y. B., Trainee at Ooty,	Soil Conservation Assistant, Coonoor.
Murthy, P. A., Trainee at Ooty,	Soil Conservation Assistant, Satyamangalam.
Navakodi, K., Sanankuppam,	Oil Seed Assistant, Tindivanam.
Narayanan, S. S., Srivaikuntam,	Cotton Assistant, Koilpatti.
Narasimhan, A., Madurai,	A. D., Aravakurichi.
Narasimhan, V. S., Trainee at Ooty,	Soil Conservation Assistant, Avanashi.
Navaneetha Krishnan, T. V., P. A., to D. A. O., Tanjore,	Assistant Lecturer in Agronomy, Coimbatore.
Palaniappan, T. A., Thudupathi,	Oil Seed Assistant, Pollachi.
Parthasarathy, K. Pongalur,	Marketing Assistant, Coimbatore.
Perumal Raja, R., Rajapalayam,	A. D., Nellikuppam.
Rangaswami, V. K., Vellalapalayam,	A. D., Punjaipuliyampatti.
Raman, M., Nanjanad,	Special A. D., Palladam.
Ranganathan, D. V., Coimbatore,	Special A. D., Cotton, Coimbatore.
Rafique Ahmed, Madurai,	A. D., Jeeyapuram, Trichy.
Ramanathan, T., Mullipet,	Oil Seed Assistant, Tindivanam.
Raju, M., Marampalayam,	A. D., Ulundurpet.
Ramanathan, G., Trainee at Ooty,	Soil Conservation Assistant, Wallajah.
Ranganathan, P. S., P. P. A., Entomology, Vellore,	A. D., Saidapet.

Name and present post	Posted as
Sriraman, K., Special Assistant Marketing Officer, Trichy,	On leave.
Soundarapandian, G., Bodinayakanur,	Assistant in Chemistry, Coimbatore.
Stephen Dorairaj, M., Somarasampatti,	Assistant in Cotton, Coimbatore,
Sayed Javad Hussain, Coimbatore,	Assistant in Cotton, Palur.
Soundararajan, J., Madurai,	A. D., Vedasandur.
Sethumadhavan, R. P., Dharapuram,	A. D., North Arcot Dt.
Kumari V. Savithri, Coimbatore,	Entomology Assistant, Coimbatore.
Selvaraj, V., Aruppukottai,	Cotton Assistant, Srivilliputhur.
Shanmugam, P., Tirupur,	A. D., Walajah.
Srinivasan, S., Kalampatti,	Millet Assistant, Koilpatti.
Sankaranarayanan, C., Special A. D., Cotton, Coimbatore,	Instructor in Agriculture, Coimbatore.
Shanmuganainar, T. P., Trainee at Ooty,	Soil Conservation Assistant, Perambalur.
Sundaram Pillai, K,, Trainee at Ooty,	Soil Conservation Assistant, Avanashi.
Vijayam, P. K., Under Training at Delhi,	Assistant in Paddy, Pattambi
Vaidyanathan, J., J, Special A. D., Vellore,	P. A., to D. A. O., Vellore.
Viswanathan, S. T., Tiruvadaimaruthur,	Allotted to Tanjore Dt.
Vasantharaj David, P., Madurai,	A. D., Oddanchatram.
Venkatesan, S., Coimbatore,	P. P. A., Pattukottai.
Viswanathan, B. S., Ootacamund,	A. D., Gingee.
Venkatnarasimhan, C., Trainee,	Agricultural Engineering Supervisor, Soil Conservation Scheme, Vellakoil.
Tyagarajan, A., Coimbatore,	A. D., Pennadam.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO A FACTUAL RECORD OF SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the month of June, 1956

Cotton: (In this Section: Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks; Tirupur: Lint: The arrivals of lint in Tirupur Market showed a slight decline compared to April and May, '56. The lint market opened with 7,364 cdys of Cambodia and 1,324 cdys of Karunganni lint. The arrivals totalled 9,321 cdys of Cambodia and 1,480 cdys of Karunganni which included 2,157 cdys of Cambodia and 253 cdys of Karunganni produced from ginneries. Total despatches of lint from Tirupur Market accounted for 9,518 cdys of Cambodia and 1,312 cdys of Karunganni, which included 2,757 cdys of lint sent to Pondicherry, Travancore-Cochin State, Bombay, Orissa, Madras, Madurai and Tirunelveli. There was a closing stock of 7,067 cdys of Cambodia and 1,492 cdys of Karunganni on 23-6-56.

Kapas; The cotton market both for lint as well as for kapas, though not active, remained firm during the month. The market commenced with a carry-over stock of 36,672 pothis of Cambodia and 3,627 pothis of Karunganni at the beginning of the month. The arrivals into the market of both Cambodia and Karunganni Kapas amounted to 17,329 pothi and 1925 pothis respectively. These arrivals include 985 pothis of Kapas got from Salem, South Arcot, Tiruchirapalli and Madurai districts. 31,676 pothis of Cambodia and 4,221 pothis of Karunganni were disposed, after leaving a closing stock of 22,325 pothis of Cambodia and 1,331 pothis of Karunganni on 23-6-56.

Koilpatti: Lint; The cotton market at Koilpatti opened with a stock of 148 cdys of Karunganni lint. Arrivals during the month amounted to 300 cdys from surounding areas. Disposals in the month amounted to 350 cdys after leaving a closing stock of 98 cdys towards the close of the month.

Kapas: The kapas market here started with 1600 pothis. Receipts from the neighbouring villages amounted to 2,500 pothis. Disposals during the month took away 3,000 pothis, leaving a month-end stock of 1,100 pothis. The arrivals declined during the month, consequent on the restriction imposed in the supply of electricity. The Uganda cotton started arriving into Sankarankoil market in substantial quantities. About 3,000 pothis of Uganda kapas were received during the month in Sankarankoil Market. Merchants from Rajapalayam and Virudhunagar are active in this market. At the end of the month the market closed with a stock of 500 pothis.

Ramanathapuram District: Lint: The karunganni lint market in the three places of Virudhunagar, Sattur, and Rajapalayam continued to be dull during the month and transactions were limited, mostly in inferior cotton. No transactions of Uganda lint have so far been reported in these places. Type samples are purchased by the firms for determining quality of the stuff and transactions are excepted to commence shortly. The stock at the beginning of the month in the three markets of this district was 700 cdys with which 2200 cdys were added from receipts. The total sales effected during the month were 1,655 cdys, leaving a closing stock of 1,245 cdys at the end of the month.

Kapas: The arrivals of karunganni kapas in the market of Virudhunagar and Sattur went down sharply during the month. There were practically no arrivals in the market at Rajapalayam. On account of the failure of seasonal rains, the second crop of Karunganni has completely failed in this district which helped the mundy merchants and leading agriculturists to hold their stocks anticipating a better price. The kapas market in this district in general was dull. Uganda kapas are just arriving into markets in a small scale. The three markets of Virudhunagar, Sattur and Rajapalayam put together started with an opening balance of 5,500 pothi of kapas at the beginning of the month. The receipts during the month amounted to 10,850 pothis while disposals accounted for 14,050 pothis. The closing balance at the end of the month was 2,300 pothis.

South Arcot District: Kapas: The condition of the standing cotton crops is not very satisfactory in this district. Pickings will be dealyed in account of recent rains. During the month 114 pothis of kapas arrived in Villupuram market, the produce being the remnants of stock of the previous year.

Cotton Prices: Tirupur: Lint: The prices of cotton lint in this market were ruling almost at the ceiling level.

Kapas: The kapas market also was steady during the month. Prices maintained a steady level.

Koilpatti: Lint: The prices of lint in this market opened at Rs. 870 to 875 for the best quality and gradually advanced to Rs. 880/- to Rs. 890/- towards the middle of the month. The prices declined later on as a result of resistance from the mill owners and touched Rs. 850/-, in the third week of the month. The low tone of the market is ascribed to the limited transactions being centred round inferior varieties.

Kapas: The prices of kapas declined from Rs. 108/- and Rs. 124/- to Rs. 100/- and Rs. 115/- per pothi. The fall in the prices of kapas was in consonance with the fall in prices of lint.

Seeds: The price of karunganni seeds advanced in the beginning of the month, but declined gradually from the middle of the month in sympathy with the fall in prices of kapas and lint. The prices which opened at Rs. 42 to Rs. 44/- at the beginning of the month advanced to Rs. 45 to 47/- towards the end of the first week and later on showed a recession at Rs. 38/- to Rs. 40/- per pothi at the close of the month.

Ramanathapuram District: Lint: The prices of lint in all the markets of this district have shown a slight recession by about Rs. 20/- per cdy over the prices of last month. The opening and closing prices of different varieties of cotton lint per cdy are extracted below:

	Opening Rates	*Closing Rates*
Karunganni ...	Rs. 857 to 870	Rs. 831 to 851
Tinny Karunganni ...	Rs. 830 to 840	Rs. 815 to 830
Tinny ...	Rs. 790 to 820	Rs. 780 to 800

Kapas: Kapas prices also have declined by Rs. 20/- per pothi during the month. The following are the opening and closing prices of kapas during the month. Prices per pothi:

	Opening rates	*Closing rates*
Karunganni ...	Rs. 104 to 112	Rs. 104 to 112
Tinny Karunganni ...	Rs. 96 to 102	Rs. 96 to 102
Tinny ...	Rs. 85 to 94	Rs. 66 to 94
Uganda	N. R.	Rs. 103 to 120

(*N. R: Not reported*)

Seeds: The prices of different varieties of cotton seeds in the three markets of this district during the month are extracted below.

	Opening rates	*Closing rates*
Karunganni	12/5 to 12/10	11/10 to 12/8
Uganda	N. R.	10/- to 10/10

(Price per maund of 82-1/3 lb.)

South Arcot District: Kapas: The prices of cotton kapas ruled steady in the markets of this district.

II. **Groundnut:** (In this section: Candy = 531 lb. of kernels.
Bag = 80 lb. of pods.)

South Arcot district: Stocks: Welcome showers were received in this district during the month which helped late-sown summer crops of groundnut and facilitated digging operations of early irrigated groundnuts and preparatory cultivation of dry lands for winter sowings. Late rains have delayed harvests of the irrigated groundnut crop. Arrivals of groundnuts in all the markets of the district were very low during the month compared to that of corresponding month of last year. Flow of produce will gain momentum only after the middle of July and may maintain a steady level till the middle of September. The transactions of groundnuts that took place during this month in district are indicated below.

Opening balance at the beginning of the month	...	3,468 tons.
Arrivals into all the markets	...	2,544 ,,
Receipts from other districts of North Arcot, Salem, Tanjore and Tiruchirapalli,	...	777 ,,
Imports from other States like Andhra	...	134 ,,
Despatches to other places to Salem, Tiruchirapalli etc.	...	763 ,,
Exports to other States like Pondicherry etc.	...	100 ,,
Consumption by oil mills	...	2290 ,,
Consumption by *chekkus*	...	231 ,,
Appropriate wastage	...	68 ,,
Closing stock at the end of the month	...	3471 ,,

Prices: The average prices of groundnut kernels in several markets ranged between Rs. 148-8-0 and Rs. 161-5-0. Easy conditions prevailed during the month. Big mill-owners were not active during the month as a result of scarcity of current. Sustained buying interest shown by the indigenous crushers coupled with the restricted arrivals were responsible for the firm market conditions during the month.

South Arcot District: Stocks: The removal of cut in electricity failed to impart the anticipated enthusiasm in the trade of groundnuts in this district. Most of the crushers had completed their first quotas and they were reluctant to enter into the market for further purchases. The opening balance with the traders in this district during the month was 1,688 tons of pods and 1,254 tons of kernels. The receipts during the month amounted to 178 tons of pods and 228 tons of kernels.

Disposals came to 379 tons of pods and 592 tons of kernels, leaving a closing stock of 1487 tons of pods and 890 tons of kernels with the trade at the end of the month.

Prices: The prices of groundnut kernels started at Rs. 163/- per cdy at the beginning of the month and continued to maintain the same level with slight variations till the end of the month. The prices during the corresponding period of last year were Rs. 88–98 per cdy.

Ramanathapuram District: Stocks: The wide-spread rains received in the south facilitated the harvest of summer groundnut in this district. Imports from other districts were limited to local requirements based on the demand in the oil market. The markets of this district started with an opening balance of 900 cdys of kernels alone. Receipts during the month amounted to 1100 tons of pods and 1350 tons of kernels, while disposals accounted for 1100 tons of pods and 1750 tons of kernels. The market closed with a stock of 500 cdys of kernels only.

Prices: The prices of kernels declined during the month by about Rs. 5/- per cdy. The opening and closing prices of groundnut pods, kernels and oil that ruled during the month in this district are extracted below.

		Opening rate:	Closing rate:
Groundnut pods (per Md. of 82$\frac{2}{7}$ lb)	...	Rs. 18 to 18/8	Rs. 16 to 18/8
Groundnut kernels per cdy	...	Rs. 160 to 168	Rs. 155 to 175
Groundnut oil (35 lb)	...	Rs. ... 22/4	Rs. 22/4 to 22/8
Groundnut oil cake (per Md. of 82$\frac{2}{7}$ lb)	...	Rs. 9/5 to 9/10	Rs. 9/8 to 9/10

III. **Gingelly:** (In this section: Bag = 168 lb.)

South Arcot District: Stock: Arrivals of gingelly into the four markets of the district amounted to 186 bags besides 234 bags held as closing balance of last month. The two markets of Tindivanam and Viruddachalam alone accounted for 174 bags of arrivals. Receipts from other neighbouring non-notified areas were 73 bags. Stocks with the producers were exhausted. Indigenous crushers were the main buyers.

Prices: On account of scarcity of stocks resulting from the failure of the crop and absence of free movement from outside, prices soared high. The average prices were ranging between Rs. 65/- and 80 in the different markets of the committee per bag. This record price of gingelly has been mainly due to bottlenecks in transport outside the Madras State.

IV. **Coconut and its products:** (In this section: Cdy = 700 lb.)

Coconuts: Stocks: Arrivals of coconuts in the markets of Malabar district were heavy during the month. With the commencement of rains, steamers have ceased to call at Malabar ports, as the sea is too rough. Exporters have to send the goods by rail up to Cochin for shipment from Cochin port. The transactions of coconuts in the markets of Malabar and South Kanara are extracted below.

(*In thousands*)

	Opening balance	Arrivals	Disposals	Closing balance
Malabar District:				
Kozhikode ...	7,465	5,600	5,400	7,665
Badagara ...	778	2,310	2,270	818
Ponnani ...	Not Reported (N. R.)			
Tellicherry & Dharmadam ...	651	897	236	612
South Kanara District:				
Mangalore ...	75	220	215	80

Prices: Prices were lowest for coconuts in Malabar as a result of increased transport charges. Low level in prices and dull trading is expected to continue till about the end of August when the rains will subside. In South Kanara also prices have declined by Rs. 5/- per 1000 nuts and the trading is dull. The maximum and maximum prices of coconuts in the markets of Malabar and South Kanara districts are extracted below:

Malabar District: (Husked, per 1000.)

	Minimum	*Maximum*
Kozhikode ...	Rs. 100	Rs. 90
Ponnani ...	,, N. R.	,, Nil
Badagara ...	,, 130	,, 85
Tellicherry & Dharmadam ...	,, 125	,, 100

South Kanara District: (per 1000 nuts.)

	Maximum	*Minimum*
Mangalore, Raw	Rs. 145	Rs. 115
do. Dry	Rs. 185	Rs. 140

Copra: Stocks: With the beginning of the monsoon in Malabar district the arrivals declined and continue to be poor. Purchasers were only the local millers. The stock particulars of copra both in Malabar and South Kanara districts are given below.

Market		Opening balance	Arrivals	Disposals	Closing balance
Malabar district: (In cdys.)					
Kozhikode	...	5,488	1,800	2,025	5,263
Badagara	...	510	2,050	1,910	650
South Kanara District:					
Mangalore (In tons)	...	116	469	500	85

Prices: Prices of copra in the markets of Malabar district have not improved during this month even though the supply is poor. The prices of different varieties of copra ruled in the markets of Malabar district are extracted below.

(*Prices per candy*)

		Kozhikode		*Badagara*	
Variety		Minimum	Maximum	Minimum	Maximum
Office	...	Rs. 290	Rs. 280	Rs. 290	Rs. 280
Edible	...	,, 300	,, 300	,, 300	,, 300
Madras	...	,, 300	,, 300	,, 300	,, 300
Rajpur	...	,, 325	,, 320	,, 325	,, 315
Gola	...	,, 302	,, 290	—	—

The prices of copra in Mangalore market ranged between Rs. 275 to 305 per candy.

V. **Arecanuts:** (In this section: Bag = 100 lb.)

Stocks: Curing of arecanut in Malabar district has started in all important centres. Transactions in raw arecanut commenced at the regulated market at Thalakadathur from 15-6-56. The stock particulars of arecanuts in the markets of Malabar and South Kanara districts are extracted below:

District,	*Opening Stock.*		*Receipts*	*Disposals*	*Closing Stock.*
Molabar Districi: (In Bags)					
Kozhikode		...	1,246	1,086	163
South Kanara District:					
Mangalore (in cwts.)	22612	...	11,900	24,200	10,312

Prices: There were keen demand for arecanuts of South Kanara district. Due to large exports the prices improved by Rs. 13/- per cwt. The market trade is uncertain because of good stocks in the market. The prices of arecanut *(supari)* in Mangalore market as between the different varieties are extracted below.

(Price in Rs. per cwt.)

		Minimum	*Maximum*
Koka	...	Rs. 80	Rs. 125
Choll	...	No stock.	
Malabar Supari	...	,, 130	,, 145
Mangalore ,,	...	,, 145	,, 174

The prices of arecanuts in the markets of Malabar district ranged between Rs. 70 to 73/4 per bag of 115½ lb.

VI. **Tobacco:** (In this section: Cdy = 700 lb.)

Tirupur: Stocks: The tobacco markets in Tirupur started with an opening balance of 11,012 cdys of chewing tobacco and 2,150 cdys of cheroot tobacco at the beginning of the month. About 50 cdys of beedi tobacco were imported from Bombay and Mysore. Despatches during the month amounted to 4575 cdys of chewing and 700 cdys of cheroot varieties made to places like Travancore Cochin State, Mysore, Malabar, Madurai, Tiruchirapalli, Tanjore, South Arcot and Madras. At the end of the month there was a closing stock of 16,875 cdys of chewing tobacco and 2,500 cdys of cheroot tobacco.

The prices of different varieties of tobacco in Tirupur market during the month are extracted below.

(Prices in Rs. per cdy of 500 lb.)

Variety		*I grade*	*II grade*	*III grade*
1. *Chewing Tobacco, (Sun-cured):*				
a. Meenampalayam	...	300 — 360	200 — 260	100 — 180
b. Other varieties	...	240 — 290	160 — 200	90 — 120
2. *Cheroot varieties .*				
Sun-cured (grown in Erode and Bhavani Taluks.)	...	240 — 300	200 — 230	120 — 160
3. *Chewing varieties :*				
Pit-cured (grown in Palladam and Sulur areas.)	...	250 — 350	175 — 250	100 — 150

Crop and Trade Reports

Potatoes — Second Forecast Report — 1955 – ,56 — Madras State: The potato crop is grown mainly in the Nilgiris district and to a small extent in Salem and Madurai districts. The area under the crop upto 25th May 1956 is estimated at 20,100 acres as against the final area of 19,000 acres for 1954–'55 representing an increase of 5·8 percent. Information in regard to winter and summer crops is given below:

Winter Crop: The area under the crop of potato is estimated at 1,500 acres as against the final area of 1,270 acres for 1954–'55 representing an increase of 18·1 percent. An increase in area is estimated in the districts of Salem and the Nilgiris. The area in Madurai district is little or negligible. The seasonal factor for the State as a whole works out to 95 percent and the total yield is estimated at 4,480 tons. Compared with the yield of 3,350 tons for 1954–'55, this shows an increase of 33·7 percent.

Summer Crop: The area under summer crop is estimated at 18,600 acres as against the final area of 17,730 acres for 1954–'55 representing an increase of 4·9 percent. An increase in area is estimated in the districts of Nilgiris and Madurai. The area in Salem district is little or negligible. The condition of the standing crop is reported to be satisfactory. The wholesale price of potatoes per standard maund of 82 2/7 lbs. or 3,200 tolas at Mettupalayam on 2—6—1956 was Rs. 15—8—0. Compared with the price of Rs. 12/- that prevailed on 3—6—1956, it shows an increase of 29·1 percent.

Bengalgram — Third and Final Forecast Report — 1955 – '56 — Madras State: The area sown with Bengalgram in the Madras State in the year 1955 – '56 is estimated at 4,410 acres. Compared with the actual area of 3,850 acres for the previous year, this is an increase of 14·5 percent. The present estimate is less than the average area of 4,730 acres for the five years ended 1954 — '55 by 6·8 percent. The area under the crop is nil or negligible in the districts of Tanjore, South Kanara and the Nilgiris. A decrease in area is estimated in the districts of Tirunelveli and the Nilgiris and an increase in the other districts of the State except Chingleput and Malabar where the area estimated is the same as that of last year. The crop has been harvested in most districts of the State. The yield per acre is expected to be normal in the district of South Arcot and slightly below normal in the other districts of the State.

The seasonal factor for the State as a whole works out to 97 percent of the normal as against 96 percent for the previous year. On this basis the total yield works out to 950 tons. Compared with the yield of 820 tons estimated for last year and an average estimated production of 840 tons calculated for the five years ended 1954 – '55, this is an increase of of 15·9 and 13·1 percent respectively. The wholesale price of bengal gram (dhall) per standard maund of 82 2/7 lb. or 3,200 tolas for the week ending 11—5—1956 was Rs. 14—6—0 at Salem and Rs. 15—3—0 at Coimbatore. Compared with the prices which prevailed in the corresponding period of last year, the current prices reveal an increase of 32·9 percent at Salem and 42·9 percent at Coimbatore.

Redgram — Third and Final Forecast Report — 1955 – '56 — Madras State: The area sown with redgram in the Madras State in 1955 – '56 is estimated at 159,800 acres. Compared with the actual area of 155,700 acres in the previous year, this is an increase of 2·6 per cent. The crop is mainly grown in the districts of South Arcot, North Arcot, Salem, Coimbatore and Tiruchirapalli. The area under the crop in the Nilgiris district is nil or negligible. A decrease in

area is estimated in South Arcot, Tanjore, Madurai and Malabar districts and an increase in area in all the other districts of the State. The seasonal factor for the State as a whole works out to 93 per cent of the normal as against 95 per cent for the previous year. On this basis the total yield works out to 22,500 tons of cleaned grain, which is the same as that estimated for the previous year. Compared with the average of 18,700 tons of cleaned gram calculated for the five years ending 1954–'55, the current year's yield shows an increase of 20 3 percent.

The wholesale price of *Tur*-dhall per standard maund of 82-2/7 lbs or 3,200 tolas on 11th May 1956 was Rs. 24—8—0 in Tirunelveli, Rs. 21—4—0 in Vellore, Rs. 18—12—0 in Tiruchirapalli and Rs. 18—6—0 in Salem, Compared with the corresponding prices which prevailed on 14th May 1955, these prices show an increase of 34.9 per cent in Salem, 36.1 per cent in Tirunelveli, 41.5 per cent in Tiruchirapalli and 59.7 percent in Vellore.

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Editorial

Fifty years ago on the 24th September 1906, Sir Arthur Lawley, the then Governor of Fort St. George laid the foundation stone of the Coimbatore Agricultural College and Research Institute. In doing so, Sir Arthur, not only laid the foundation of this great Institute, but laid the real foundations for agricultural progress of our country. It was an event of great significance that had far reaching results on the farming community of not only Madras but the whole of India. We take pride in recording the event in this issue, as our Journal is but a part of the life of this Institute.

Fifty years is but a short period in the history of a nation, but is a sufficiently long period for an institution of this kind, for, these fiity years can aptly be described as the period of Renaissance for Indian Agriculture. These fifty years have brought about many achievements as well as amazing possibilities in the application of science in the field of Agriculture. Indeed, science has indicated solutions for quite a formidable array of problems that confront the farmer.

Verily, when we look round this era of technological progress, the picture is incredibly complex. Here is progress in the management of the soil. We know more about the soil and its behaviour to cultivation operations. Our knowledge about the nutrient requirements of crop plants and the nutrient levels necessary for higher productivity has become more definite. Here are better bred varieties of crops that can yield more, resist diseases better and tolerate adverse invironments. The 'know-how' to control pests and diseases has become more clear cut and certain, and no longer need the farmer worry so about the enemies

of his crops as he used to previously. Indeed, Agricultural Research has multiplied the yields of crops and banished hunger for the fast-growing populations.

The continuity of research and its translation into practice need the creation of a class of men who have received the education and training in farming methods on modern lines. The Coimbatore Agricultural College has contributed the necessary personnel and during these fifty years has produced several diploma holders in the early years of its existence and 1476 B. Sc. (Ag.) graduates since the institution of the degree course in 1920.

Here then is a great Institute and the band of enlightened workers-past and present, who have their place in the roll of honour set out by Swift. They made it possible to grow two ears of corn or two blades of grass where only one grew before and thus did essential service to the country and deserved much of mankind.

Even so, there is reason not to be complacent. More progress brings in more problems. Our systems themselves may be imperfect, there are many gaps in our knowledge, but they are always improving and always capable of further improvement. We, on this great occasion of the fiftieth year of Agricultural College and Research Institute at Coimbatore dedicate ourselves to this new task–to the achievement of greater progress–watched by the Founders but leaving the judgement to posterity.

Variability in Size and Frequency of Stomata in Leaves of Rice Varieties and its Correlation in Drought Resistance *

by

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Introduction: For an understanding of water economy in the rice plant it is essential to study the mechanism by which water is transpired in the plant. Transpiration takes place through the cuticle as well as through the stomata. In general it is recognised that in mesophytes, stomatal transpiration is 80 to 97 percent whereas cuticular transpiration is only 2 to 3 per cent. The total stomatal apertures in spite of their large number, occupy only one to two per cent of the total leaf surface. 'The epidermis along with the stomata possesses the physical properties of a multi-perforate septum and the diffusion of gases through these minute apertures proceeds almost at the same rate as if the cutinised epidermis were actually removed and the cells of the mesophyll were in direct contact with the external atmosphere'. It may be seen therefore that the stomata do play a very great part in the water balance of plants. The present study is restricted to stomatal sizes and their frequency in leaves of rice varities.

Review of Literature: Darwin (1898) (quoted by Knight, 1917) considered that stomata play a predominant part in the control of transpiration. Lloyd (1908) concluded that though the change in the stomatal dimension is small, this does not exclude the possibility of the stomatal opening exerting any regulatory effect upon transpiration. Knight (1917) found no agreement between stomatal aperture and the rate of transpiration and concluded that the water content of the leaf was an important factor involved in the control of transpiration. Loftfield (1921) after an elaborate study of the behaviour of stomata under a variety of external conditions found that at certain specific aperture, the stomata control transpiration.

Eckerson (1908) found that marked variations in number and size of stomata occur not only in different varieties of the same species of common green house plants, but also in the same varieties grown under different conditions. Zalenski (1904) (reviewed by Maximov, 1929) studied the anatomical differences in leaves at

* Paper awarded the Ramasastrulu Munagala Prize for 1956.

different levels in the stem and found that the higher the leaf, the greater the number of stomata per unit area of the leaf surface. Yapp (1912) reports that the upper xeromorphic leaves of *Spiraea ulmaria* have 1300 stomata per square millimeter whereas the mesomorphic leaves of the same plant had about 300 stomata per square mm. Salisbury (1927) in an extensive study of the stomatal frequency of the woodland flora of England concluded that stomatal frequency is mainly dependent on the humidity of the environment, dry exposed conditions being associated with high frequencies and humid conditions with low frequencies. Miller (1938) found that the number of stomata varies greatly from year to year and most of the plants have more stomata on the lower surface than on the upper surface, when stomata occur on both surfaces.

Hirano (1931) found that the hardier varieties and species of *Citrus* trees are characterised by lower stomatal density, though there were some exceptions. In the material studied by him it was found that the density of stomata is governed by genetio factors. Yocum (1935) reported a maximum of 1900 stomata per sq. mm. in Spanish oaks and suggests that the action of stomata is very important in trees, where the soil water is limited. Kolkunov (1905) (reviewed by Maximov, 1929) and Pavlov (1931) found that the less drought resistant wheats had longer stomata than the most resistant wheats. Whiteside (1941) observed that the leaf size, the distance between the stomata and other morphological characters were affected when plants were grown under low moisture supply. Evans (1939) working on the drought resistance in sugarcane varieties dit not find any correlation between the rate of transpiration and the density of stomata. He found approximately double the number of stomata per unit area on the lower spidermis as compared to the upper epidermis. Lal and Mehrotra (1949) studying the 12 varieties of sugarcane with varying degress of drought resistance measured the length, width and number of stomata and found the stomatal index. They suggest that the lower the index, the greater was the drought resistant capacity of the cane.

Differences in anatomical structures have been observed in rice varieties which differed in their degree of registance to drought. Yasuda (1924) studied the relation between amount of transpiration and the development of vascular system. He found that the most important internal factors concerned are the structure, the number

and the function of stomata and the nature of the epidermal cells. Onodera (1930) observed that in lowland rice the 'Sterome' or mechanical tissue is well developed on the lower side of the leaf while in some of the upland rices its development is much feebler. Alam (1939) observed that the varieties which stood drought when grown under artifical conditions of irrigation had fewer stomata and in them the stomatal cells were also smaller.

Materials and Methods: The present study was made to find out the variability in stomatal size and stomatal frequency in rice varieties which exhibited different degrees of resistance to drought. Two parents and one drought resistant F_4 progeny have also been studied in detail for the same purpose. The arrangement of the stomata, the size of the stomata, length and breadth and the frequency of the stomata have been studied.

Fourteen varieties of rice viz., CEB. 24, Co. 13 (wet rices), MTU. 17, MTU. 18, Vedurusannam, PTB. 28, PTB. 29, PTB. 30, TKM. 1, TKM. 2 and Bairuvadlu (dry rices), T. 129, T. 740 and T. 1702 (Wild rices, *Orysa sativa* forma *spontanea*), were grown under uniform conditions in a wet field. The plants were 60 days old and the fixing of the material was done between 9 A. M. and 10 A. M. as followed by Eckerson (1908) when the stomatal pores would be wide open. For a detailed study of the stomata in parents and their progeny, the cross Co. 13 × T. 129 was chosen. These were grown under restricted irrigation and were 53 days old when the material was taken.

Formalin acetic alcohol (70% alcohol - 90 c.c.; acetic acid 4 c.c. and formalin 6 c.c.) was used for fixing the samples. Leaf portions from the middle of the leaf blade were out and quickly dropped into the fixative to avoid any alterations in the stomatal dimensions. For the varietal study the first leaf from the top of the plant was taken and for intensive study with the two parents and a progeny the first, second and third leaf from the top were fixed. Scrapping with a sharp scalpel as done by Prat (1932) was followed in obtaining the epidermal peel. Acetic orcein (1 gm. orcein dissolved in hot 42 per cent acetic acid) was used as the mounting medium. This medium has the tendency to expand the stomata which would have undergone shrinkage while getting fixed. A spencer's microscope with eye piece 10 × fitted with a micrometer with 100 divisions and objective with 4 M. M. - N.A.O. 6 - 44 × was used. Readings were taken to the nearest micrometer division.

In a preliminary study it was found that in the regions adjacent to the mid rib the parenchymatous cells are more and the veins are far apart, whereas towards the margin the parenchymatous cells are fewer in rows and the veins are closer. Moreover, it was found that the epidermal peels, both of the lower and upper epidermis, were easily obtained in the mid-rib region. Hence uniformly in all the samples epidermal peels in the mid-rib region alone were taken for study. Both the upper and lower epidermis were studied in all the varieties since stomata are found in both the epidermis. For obtaining the upper epidermis the scraping was begun from the lower layer and vice versa for the lower epidermis.

Size of the stomata was determined by measuring both length and breadth of the guard cells. Hundred stomata were measured for their length and breadth in each of the variety studied and the means calculated. The frequency of the stomata was measured by counting the number of stomata which are included in 100 divisions of the micrometer in a row. Twenty five readings were taken in the lower and the upper epidermis for each variety and the mean calculated. Rows of stomata adjacent to the mid-rib were taken for measuring the frequency. The arrangement of the stomata was studied with a view to find the distance between the stomatal rows, as they occur in linear rows alternating with longitudinal cells. The distance between the two veins was measured in three places where the stomatal rows were counted and the mean calculated. The distance between individual rows was found by dividing the number of rows.

Observation: In the internal structure of the rice leaf, which is exposed to the light of the sun on both sides, the mesophyll presents no differentiation into palisade and spongy parenchyma. The whole of the mesophyll consists of compactly arranged parenchymatous cells. The cells of the upper epidermis have large motor cells which help in the rolling of the leaf (plate No. 1). The epidermis is a continuous layer consisting of flattened cells with their cell walls distinctly cutinised. The continuity of the epidermis is interrupted by stomata, the guard cells of which are dumbbell shaped.

Rice leaf being an isobilateral monocot leaf has stomata on both lower and upper epidermis. This feature introduces a special problem in the study, as to which surface is more important for comparison. Therefore for comparing the varieties in their size and number of stomata, details have been given for both the sides separately.

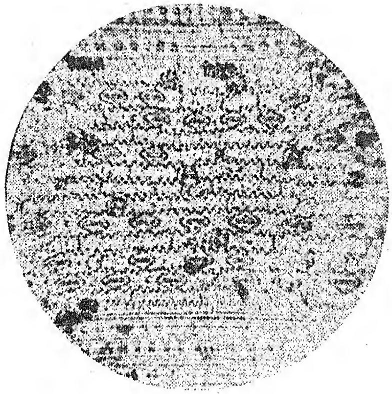

PLATE 1

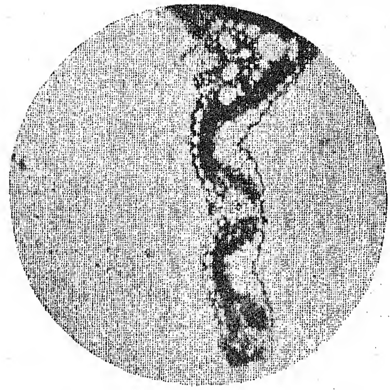

PLATE 2

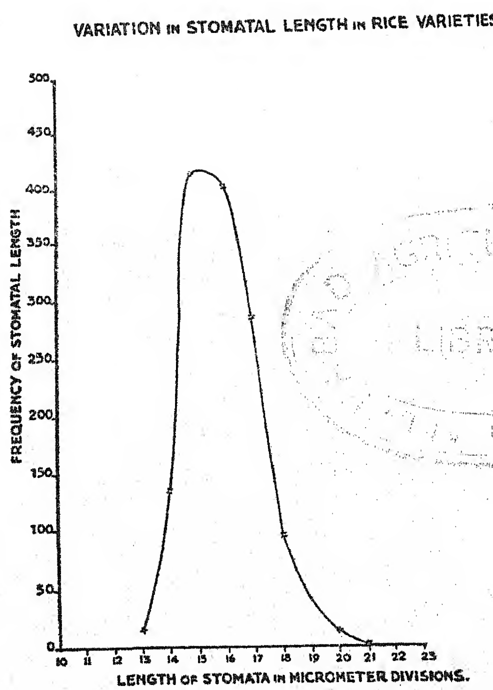

PLATE 3

The epidermis of the rice leaf shows veins running parallel to each other. The main conducting vessel is the midrib and the veins are parallel to the midrib. In between two veins, stomata are found in rows alternating with bands of long cells which have distinctive ripple walls (plate No. 2). The distance between two veins is larger in the midrib region and gets reduced towards the margin of the leaf.

The number of rows of stomata depends upon the distance between the two adjacent veins where they are distributed. Table 1 gives the distance between the two veins and the number of rows of stomata in between the two veins in the 14 rice varieties studied. The distance between the two rows of stomata is greater in the upper epidermis than in the lower epidermis showing that there are fewer rows of stomata in the upper epidermis than in the lower epidermis. This fact was observed in all the varieties studied. Table 3 which gives the data for the two parents and the F. 4 progeny also indicate the same features in the first, second and third leaf of the rice plant. Hence it is confirmed that the upper epidermis has fewer stomata than the lower epidermis in the rice leaf.

The distance between the rows of stomata varies and there are indications that some of the varieties have their stomata in rows farther apart. In the short duration varieties, it is seen, that some of the drought resistant types have their stomatal rows farther apart in both the epidermis. In the medium duration group it is noticed that except in the case of the lower epidermis of the wild rice T. 740, all the other drought resistant types have fewer stomatal rows than in the case of the drought susceptible type CEB. 24.

Similarly, the drought resistant progeny No. 3115 and the parent T. 129 have their stomatal rows farther apart than in the case of the drought susceptible parent Co. 13 as seen in table 3. (I leaf).

The size of stomata was studied by measuring the length as well as the breadth of the guard cells. The data are presented in tables 2 and 4. It is seen that the breadth of the stomata is less variable than the length. The average breadth in the lower epidermis mostly ranges between 9.5 and 10.5 micrometer divisions, i, e. 15.2 μ and 16.8 μ with a few exceptions as seen in table 4, where the maximum breadth is 11.4 micrometer divisions. The

breadth of stomata is not directly proportional to the length but the trend seems to be for breadth to increase with length. The breadth of the stomata is greater in the upper epidermis than in the lower epidermis. The difference in breadth between the varieties and between the parents and progeny is not marked.

There is a great range of variation in the length of the stomata. The average length of the stomata in the lower epidermis ranges between 13 and 21 micrometer divisions which corresponds to 20.8 μ and 33.1 μ. Table 5 and the graph (plate No. 3) give the frequency of stomatal length in rice varieties, in the lower epidermis of the first leaf. It shows that most of the stomata have a length of 15 to 16 micrometer divisions or 24.0 μ to 25.6 μ. Stomata in the upper epidermis are longer than those in the lower epidermis. The differences in stomatal length between the varieties apparently show that they do not bear any relation to the drought resistant habit of the rice varieties studied. The length of the stomata in the three leaves studied in the two parents and progeny show that there is a gradual increase in length of the stomata from the first leaf to the third leaf as seen from table 4 the only exception being in the lower epidermis of T. 129. The breadth of the stomata closely follows the length in this respect.

However, the length of the stomata varies with varieties, with different leaves in the same plant and with conditions under which it is grown. The effect of change in environment of stomatal length and breadth is seen in varieties Co. 13 and T. 129 (table 2 and 4) which record different sizes. Thus it is noted that in the first instance (table 2), Co. 13 has a stomatal length of 15·7 micrometer divisions and a breadth of 10·3 micrometer divisions in the lower epidermis whereas the length is 16·5 and breadth 9·9 micrometer divisions in the first leaf of the same variety in the second case (table 4). A similar difference is noticed in the upper epidermis also. Another variety, T. 129 which was also studied in two instances (table 2 and 4) has different sizes of stomata. Leaves were taken for study from plants grown under two different conditions and the size of stomata is seen to vary in the different environments.

Apart from the environmental effect, there appears to be a genetic difference between the varieties in the size of stomata as seen from table 4, where the data for the two parents Co. 13 and T. 129 and the progeny number 3115 are given. It is seen that size of stomata of the progeny is different from that of both the parents

in the lower and the upper epidermis in all the three leaves studied. An analysis of the data of the third leaf of the lower epidermis shows that the progeny number 3115 has significantly greater stomatal length than both the parents. The difference of length of stomata in the progeny in highly significant when compared to the parents (table 6). The progeny has a mean stomatal length of 19·10 micrometer divisions as compared to a mean length of 16·81 micrometer divisions in the cultivated rice, Co. 13 and a mean length of 15·70 micrometer divisions in the case of the wild rice T. 129. The length of stomata in Co. 13 is also significantly greater than that of T. 129 which shows that in this case the drought resistant rice has smaller stomata.

The frequency of stomata was measured by counting the number of stomata in 100 divisions of the micrometer at 25 places which is given in columns 5 and 8 of table 2 and 4. The varieties studied do not show that the difference in frequency between them has any bearing on their drought resistant and drought susceptible habits.

The frequencies of stomata in the first, second and third leaf in the two parents and the progeny (table 4) clearly show that there are definitely fewer stomata per unit length in the third leaf than in the top leaf of the same plant. The number stomata per unit length gets reduced gradually from the top leaf to the third leaf in almost all the cases in both the epidermis. An exception is noticed in the upper epidermis of T. 129. As the size of stomata becomes larger from the top leaf to the bottom leaf, the number gets reduced and this fact is noticed from the data presented. A typical example of this is noticed in the progeny number 3·15. In the lower epidermis, the length of stomata is 16·2, 18·8 and 19·1 micrometer divisions in the first, second and third leaf respectively whereas the number of stomata in 25 $\times$ 100 micrometer divisions are 74, 67 and 60 which shows a gradual reduction from the top leaf to the third leaf.

Discussion: Among the anatomical features which characterise drought resistance are the structure and size of cells, hairiness of stem and leaves and development of 'Sterome' or mechanical tissue. Differences in anatomical structures in rice varieties which differed in their degree of resistance to drought have been observed by Onodera (1930) and Alam (1939).

In the present investigation the stomatal studies in rice have been made on fairly large samples. The study has been made in

one of the drought resistant hybrid progenies, its parents and some of the reputed drought resistant rice varieties.

The results obtained show that stomata are fewer in the upper epidermis because of the stomatal rows being fewer and farther apart in the upper epidermis than in the corresponding lower epidermis. Rice leaf bears stomata on both the upper and lower epidermis since it is equally illuminated on both the sides owing to the isobilateral disposition of the leaf. The general arrangement of the stomata in rows parallel to veins has facilitated the adoption of a definite method in studying them. The distance between the two rows gives an idea whether the stomatal rows are closer or farther apart. When the distance between rows is more, there are fewer rows of stomata in between two adjacent veins. Thus it has been possible to find out that the upper epidermis has fewer stomata than the lower epidermis. The differences between the drought resistant and susceptible rice varieties as well between the two parents their progeny are not constant though some of the reputed dry rices and wild rices have their stomata farther apart. Hence it has not been possible to associate their drought resistance with fewer stomata.

In the detailed study of the two parents and their progeny where the first, second and third leaf of the same plant have been examined, it has been found that the distance between rows in the lower and upper epidermis has a constant variability. The distance was the least in the wet rice Co. 13 and the wild parent and the drought resistant progeny have their stomatal rows very far apart compared to the wet rice. In both the epidermis the drought resistant progeny has fewer rows of stomata.

In studying the size, both length and breadth have been taken into account. It has been found that the breadth is less variable than the length. Though the breadth is not directly proportional to length, the tendency is for it to increase with the length. There is a greater variation in length of the stomata as shown in tables 2 and 4. The length ranges from $20{\cdot}8\mu$ to $33{\cdot}1\mu$ in the lower epidermis of the 14 rice varieties studied. The study of the first, second and third leaf of the rice plant revealed that in the same plant, the length of stomata increases from the top leaf to the third leaf in both the lower and upper epidermis. This corresponds to what zalenski (1905) (quoted by Maximov 1929) and Yapp (1912) found in their studies on stomata in relation to the height of insertion. They came to the conclusion that the upper leaves are more Xeromorphic than the lower ones.

Size of stomata seems to be a varietal character and the variation in size is due to the genetic make-up of the plant. A comparison of the stomatal length in the lower epidermis of the third leaf of Co. 13, T. 129 and the hybrid progeny No. 3115 has shown that the progeny has a significantly longer stomata than both the parents. The study has shown that the size of stomata does not indicate the drought resistance in the rice plant. It varies from leaf to leaf and between varieties.

The frequency of stomatal distribution in the epidermis of the rice plant shows that the number of stomata in an unit distance decreases from the top to the bottom leaf in both the epidermis. This is due to the fact that the size of the stomata increases from the top leaf to the bottom leaf as has already been stated. The study of the varieties has not given any indication to signify their varietal drought resistance.

Summary: The arrangement, size and frequency of stomata in two parents and a progeny and 14 varieties studied showed that the stomata are fewer in the upper epidermis than in the lower epidermis. No significant difference in stomatal size is noticed between the drought resistant and drought susceptible types though it has been observed that the progeny has a significantly greater stomatal length than both the parents. It has also been established that the size of stomata is a genetic character and found to be affected by environments. The size of stomata was also found to increase from the top leaf to the third leaf whereas the frequency decreased and this is in confirmation with what other workers have found in some other crops.

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TABLE 1

Spacing of Stomatal rows in Rice Varieties

(Mean values)

S. No.	Name of variety		Lower epidermis: Number of rows of stomata between two veins	Lower epidermis: Distance between two veins (Micro-meter divisions)	Lower epidermis: Distance between rows of stomata (Micro-meter divisions)	Upper epidermis: Number of rows of stomata between two veins	Upper epidermis: Distance between two veins (Micro-meter divisions)	Upper epidermis: Distance between rows of stomata (Micro-meter divisions)
1	2		3	4	5	6	7	8
Short Duration:								
1.	Co. 13	(wet rice)	8·1	110	13·8	6·0	120	20·0
2.	MTU. 17	(dry rice)	14·0	200	14·3	6·7	183	27·4
3.	MTU. 18	do.	8·7	120	13·8	7·0	170	24·3
4.	PTB. 28	do.	10·0	110	11·0	8·5	135	15·9
5.	PTB. 29	do.	10·3	140	14·0	6·7	160	23·9
6.	PTB. 30	do.	8·3	150	18·0	5·3	136	25·5
7.	Vedurusannam	do.	8·5	185	21·8	3·7	130	35·4
Medium Duration:								
8.	GEB. 24	(wet rice)	8·0	115	14·4	7·0	115	16·4
9.	TKM. 1	(dry rice)	8·5	135	15·9	8·5	150	17·7
10.	TKM. 2	do.	7·0	150	21·4	4·0	115	28·8
11.	Bairuvadlu	do.	7·7	115	14·9	6·3	115	18·2
12.	T. 129	(wild rice)	6·7	135	20·4	4·3	117	27·0
	Oryza sativa forma *spontanea*							
13.	T. 740	do.	11·3	138	12·2	6·3	130	20·5
14.	T. 1702	do.	6·0	125	20·8	5·3	152	28·5

TABLE 2

Size and frequency of stomata in rice varieties

(Mean values)

S. No.	Name of variety	Lower epidermis: Length of stomata (Micro-meter divisions)	Lower epidermis: Breadth of stomata (Micro-meter divisions)	Lower epidermis: Number of stomata in 25 x 100 (Micro-meter divisions)	Upper epidermis: Length of stomata (Micro-meter divisions)	Upper epidermis: Breadth of stomata (Micro-meter divisions)	Upper epidermis: Number of stomata in 25 x 100 (Micro-meter divisions)
1	2	3	4	5	6	7	8
Short Duration:							
1.	Co. 13 (wet rice)	15·7	10·3	74	15·7	10·4	79
2.	MTU. 17 (dry rice)	15·2	9·9	60	15·3	10·1	68
3.	MTU. 18 do.	14·9	9·8	69	16·4	9·9	64
4.	PTB. 28 do.	14·5	9·5	74	14·8	9·9	64
5.	PTB. 29 do.	14·7	9·8	79	15·6	9·9	76
6.	PTB. 30 do.	16·2	10·2	70	15·5	10·3	77
7.	Vedurusannam do.	18·5	10·3	68	17·6	10·0	71
Medium Duration:							
8.	GEB. 24 (wet rice)	15·8	9·9	70	14·7	10·2	64
9.	TKM. 1 (dry rice)	16·4	10·1	70	15·9	10·2	74
10.	TKM. 2 do.	16·8	10·3	69	16·7	10·3	67
11.	Bairuvadlu do.	15·2	9·4	64	15·5	9·8	72
12.	T. 129 (wild rice) *Oryza sativa* forma *spontanea*	15·9	10·0	65	16·4	10·3	59
13.	T. 740 do.	15·3	9·7	75	15·2	9·9	81
14.	T. 1702 do.	16·7	10·1	78	16·4	10·0	72

TABLE 3

Spacing af stomatal rows in parents and progeny of drought resistant cross Co. 13 × T. 129
(Mean values)

S. No.	Name of variety	Lower epidermis: Number of rows of stomata between two veins	Lower epidermis: Distance between two veins (Micro-meter divisions)	Lower epidermis: Distance between rows of stomata (Micro-meter divisions)	Upper epidermis: Number of rows of stomata between two veins	Upper epidermis: Distance between two veins (Micro-meter divisions)	Upper epidermis: Distance between rows of stomata (Micro-meter divisions)
1	2	3	4	5	6	7	8
1.	Co. 13 (wet rice):						
	I leaf	7·3	125	17·1	6·0	100	16·7
	II leaf	8·0	140	17·5	4·5	110	24·4
	III leaf	5·7	125	21·9	3·0	110	36·7
2.	3115 (P_4 progeny):						
	I leaf	3·0	105	35·0	2·0	80	40·0
	II leaf	6·5	155	23·9	2·7	125	46·8
	III leaf	7·5	115	15·3	3·0	115	38·3
3.	T. 129 (wild rice) *Oryza sativa* forma *spontanea*:						
	I leaf	3·8	105	28·0	4·0	115	28·8
	II leaf	7·7	130	16·9	2·0	67	33·5
	III leaf	4·3	119	25·4	4·0	110	27·5

TABLE 4

Size and frequency of stomata in parents and progeny of drought resistant cross Co. 13 x T. 129

(Mean values)

S. No.	Name of variety	Lower epidermis: Length of stomata (Micro-meter divisions)	Lower epidermis: Breadth of stomata (Micro-meter divisions)	Lower epidermis: Number of stomata in 25 x 100 (Micro-meter divisions)	Upper epidermis: Length of stomata (Micro-meter divisions)	Upper epidermis: Breadth of stomata (Micro-meter divisions)	Upper epidermis: Number of stomata in 25 x 100 (Micro-meter divisions)
1	2	3	4	5	6	7	8
1.	Co. 13 (wet rice):						
	I leaf	16·5	9·9	73	16·0	10·1	79
	II leaf	16·7	10·1	67	17·1	10·2	79
	III leaf	16·8	11·4	64	17·3	10·4	75
2.	3115 (F_4 progeny):						
	I leaf	16·2	10·4	74	15·8	10·2	86
	II leaf	18·8	10·8	67	16·9	10·1	77
	III leaf	19·1	11·0	60	18·7	11·2	70
3.	T. 129 (wild rice) *Oryza sativa* forma *spontanea*:						
	I leaf	13·2	9·3	81	17·4	10·0	60
	II leaf	17·3	10·8	69	17·7	10·6	57
	III leaf	15·7	9·9	68	18·9	10·7	60

TABLE 5

Frequencies of stomata length in rice varieties
First leaf–Lower epidermis

Serial No.	Name of variety	Length of stomatat in micrometer divisions								
		13	14	15	16	17	18	19	20	21
1.	Co. 13			5	23	61	11			
2.	MTU. 17		11	59	29	1				
3.	MTU. 18		18	69	11	2				
4.	PTB. 28	10	46	43	1					
5.	PTB. 29	4	30	58	8					
6.	PTB. 30		2	8	42	39	8	1		
7.	Vedurusannum				3	16	35	33	12	1
8.	GEB. 24			29	60	11				
9.	TKM. 1			7	49	39	5			
10.	TKM. 2			4	24	52	18	2		
11.	Bairuvadlu		12	56	28	4				
12.	T. 129		6	27	44	20	3			
13.	T. 740		10	45	43	2				
14.	T. 1702			5	37	39	17	2		
	Total ..	14	135	415	402	286	97	38	12	1

TABLE 6

Comparison of length of stomata between parents and a progeny of drought resistant cross Co. 13 x T. 129

Mean length of stomata in micro-meter divisions:

Co. 13 (cultivated parent) = 16·81
T. 129 (wild parent) = 15·70
F_4 progeny No. 3115 = 19·10

S. No.	Particulars of comparison	Difference between means (d)	Standard error of the difference between means (Ed)	$\frac{d}{Ed}$
1.	Co. 13 and 3115	2·29	0·131	17·46*
2.	Co. 13 and T. 129	1·11	0·123	9·06*
3.	3115 and T. 129	3·40	0·130	26·08*

* Highly significant

Agriculture in Australia — I

by

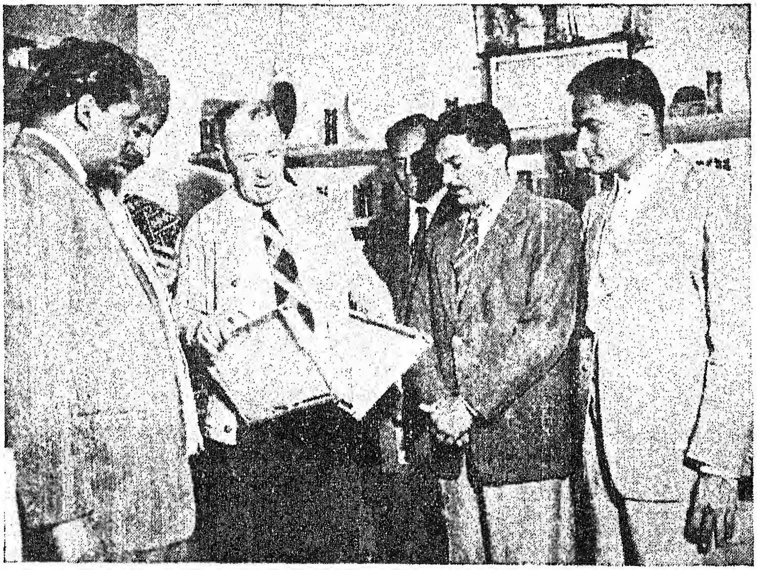
C. L. SUNDARARAJAN, B. SC. (Ag.)

The world wide distress that prevailed in the wake of World War II compelled the major powers to institute in 1950 what is known as the Colombo Plan, to render monetary and technical assistance to the South East Asian countries, to improve their living standards. Development work has been carried out so far at a cost of nearly two millian pounds, of which four fifths is provided by the pacticipating countries themselves and the balance is contributed by the United Kingdom, Canada and Australia. Under this Colombo Plan, a part of Indian Farmers were enabled to make an educational tour of Australia to see how far the methods adopted by the Australian farmers, who are reported to be the most progressive in the world could be utilised to improve the farming practices and crop production in India.

It was under this scheme that we, a party of Indian farmers, were sent to Australia. Most of the nominees are graduates in agriculture and are also practising farmers, representative of various parts of India. We arrived in Australia in the middle of November 1955 and stayed on till the first week of June 1956.

We were taken first to Canberra where we were given a series of lectures on all aspects of Australian farming. From then on, we were taken on a conducted tour to the various parts of New South Wales and Victoria, where we visited sheep stations, dairy farms, wheat farms and orchard areas. We visited a few of the Agricultural Colleges, Research Institutes, and Experiment Stations of the Department of Agriculture and of The Council of Scientific and Industrial Research Organisation. For a period of five weeks we were privileged to stay as guests, in the homes of private farmers in the fertile Murrumbidgee Irrigation Areas. This unique opportunity enabled us to come in close contact and work with the Australian farmer. After a detailed visit to the Royal Agricultural Show at Sydney, where we were given training in judging farm and animal produce and animals the party dispersed to different areas to specialise in the subjects of their choice. A few of us went to Queensland to study the cultivation of tropical crops, especially sugarcane.

INDIAN FARMERS SEE THE VARIETY OF AUSTRALIA'S AGRICULTURE



A party of 15 Indian farmers who were in Australia for six months under the Colombo Plan to study farm methods visited Hawkesbury Agricultural College at Richmond, about 40 miles from Sydney, the capital of the State of New South Wales. The farmers inspected citrus growing, canning, bee-keeping, vineyards and other crops. Mr. J. M. Mead, an instructor at Hawkesbury Agricultural College, showing honeycombs in the bee-keeping section to the Indian farmers.

(Left to right) Messrs. C. S. Gelda (Jaipur), Satwant Singh (Pepsu), C. L. Sundararajan (Madras), K. K. Bhargave (Jabalpur) and L. N. Kolhe (Bombay State).

Farmers from India, in discussion with Australian scientists, at the Royal Agricultural Show, Sydney.

The Government of Australia had taken great pains to draw up our programme and carry it out to detail. There was nothing lacking by way of amenities provided or the facilities given for study of the problems, social and economic. The general public gave us a spontaneous welcome and our grateful thanks are due to the Government and people of Australia who did their best to make our stay both enjoyable and instructive.

Geographical Features: Australia is the smallest continent and the biggest island. It has an area of 2·97 million sq. miles — almost as large as the U. S. A., or 2½ times bigger than India. Geographically, Australia is the oldest continent. It has the most level surface and has no towering peaks, the highest peak being the Mount Kosciusko in New South Wales (7328 ft.)

On the whole, Australia is a continent of scanty rainfall. The North East Coast of Queensland receives the highest rainfall (160″) and is of the monsoon type (summer rains). The Westerly winds skirt the Southern shores and bring reliable light to moderate rains to the southern part of the continent. This is the winter rainfall area. 37% of the entire area has a rainfall less than 10 inches and is, in effect, a desert. The main river system is that of the Murray and its tributaries the Murrumbidgee, the Lachlan and Darling. This area is highly developed due to extensive development of irrigation works.

Dense forests are found in the tropical North and open park-like forests abound the Eastern sea board. Beyond the mountains are the grass land zones with Acacias. Eucalyptus is the national tree and 600 species of it inhabit the different zones.

The average density of population is 3·02 persons per square mile, and is, therefore, the most sparsely populated of all the civilized countries of the world. The density is the highest in Victoria with 27·9 persons per square mile. 53·9% of all the population live near the coasts in 6 capital cities with a further 24·8% in other urban areas. The rural areas account for only 21% of the population. Most Australians live near the coasts mainly in south and south east and relatively few live in the north and in centre. The large population in the urban areas is an index of the growing importance of industry and commerce in the economy of the country.

The population of Australia is about 9 millions, 16% of which is engaged in agriculture and primary industries, 28·2% in the manufacturing and 55·3% in the tertiary industries.

Australia is mainly a pastoral and agricultural country though, of late, many new industries have sprung up and she is bidding to become an exporter of manufactured articles. The net value of primary production in primary industries in 1953—1954 was £ 1092 millions as opposed to that of £ 1231 millions from secondary industries.

Australia's greatest rural industry is wool growing, followed by wheat, cattle and sugarcane. Other important products are fruits and vegetables.

General Conditions of farming: Australia is truly blessed with a variety of soils in different climatic regions. Land is available in plenty and man has the option to pick and choose the type of land best suited to his type of farming. Since the population is small, each farmer is assured of an acreage as would give him a good standard of living. The acreage, of course, depends upon the type of farming and fertility of the land. Fallowing and green manuring are extensively practised and the modern tendency in many of the farms is to have a harmonious combination of sheep and beef cattle raising in conjuction with cereal farming. A 3 to 5 year rotation is followed and use of nitrogenous fertilisers is almost wholly restricted to sugarcane and other commercial crops, while use of superphosphate and of minor elements, wherever necessary, is widely prevalent. Each individual farm is enclosed by barbed wire fencing and each farm is self-contained with its own farm house, quarters for the employees, (permanent and seasonal) and buildings to house the machinery. Scarcity of water is the bane of the country and water for domestic use is collected and stored off in tanks from the corrugated iron sheet roofs of the homestead.

Agricultural Labour: Shortage of labour is an expression one hears often. Labour, as understood in the densely populated parts of the world, is unknown, and the farmer has to rely on his own strenth and ingenuity for carrying out all the operations on the farm. He needs not only to be a good tiller of the soil but must be a skilled mechanic, an efficient veterinarian, an able engineer and to a lesser extent these days, a good cobbler too. No job is too big and nothing too mean for him. A number of labour-saving devices and implements are perforce devised and utilised on the farm and in the house to minimise the drudgery of every-day operations. The farmer works long hours during the season and constructs or repairs farm buildings or machinery during the off

season. A few hands are employed during the harvest season to assist the farmer in his work. The farmer's wife knows of no help to assist her in housekeeping.

The farmer reads the latest journals and text books on subjects of his choice and is thoroughly conversant with the latest developments. It often happens that a farmer is well ahead of the Experimental stations in the adoption of improved cultural methods or of new varieties of crops.

Employee-labour is not very efficient. All employees are by law compelled to be members of the Australian Workers' Union, and their conditions of service, scales of pay, work-load etc. are governed by various awards of Industrial tribunals. Each one is assured of a basic or living wage and it is illegal to offer or accept any wage lower than the basic wage. This basic wage is revised every quarter according to the cost of living Index. The basic wage is defined "as the minimum wage for unskilled labourers at a standard appropriate to the normal needs of the average employee regarded as a human being living in a civilized community." At present the basic wage is about £ 13/- for a 40 hours week. The disparity in income between different strata of society is small and hence the standard of living of the population as a whole is high. No home, not even of a labourer is complete without a radio, frigidaire and many other equipments.

Agricultural Education: No village, as known in India, exists here. Each farmer lives on his own farm for the efficient management of it. The Government does not grudge spending any amount on the provision of amenities to the rural areas. Rural electrification is highly developed and extension of telephone and other means of communication have made rapid strides. Primary and secondary schools have been started in rural areas and the State-organised transport for children attending these rural schools have alone cost the treasury £ $2\frac{1}{4}$ millions in 1953 — 1954. Medical aid is available in every area though the need for it is limited because of the robust health of the population.

The farmers' children grow in natural surroundings, develop a liking for farming and, in a few instances, complete their education by attending one of the colleges of Agriculture. More than 60% of the products of the college go back to land and the Nation is the better for having a set of practical farmers well versed with the theory of it.

Agriculture is given a prominent place in the curriculum of rural schools. In the colleges of Agriculture greater emphasis is laid on the practical training with the minimum of theory. These colleges award diplomas and students having an appetite for scientific research go up to Schools of Agriculture in the Universities for their degree courses.

Farm finance: The Australian farmer is not handicapped for want of capital to carry on the farming operations. Government agencies like the Rural Bank of New South Wales advance appreciable amounts to the farmers on the security of their lands. Merchant houses and Banking Institutions have branches in all rural areas and advance loans to farmers at reasonable rates of interest (5 to 6% per annum). Co-operative Banks are conspicuous by their absence. The whole structure of rural finance is based on solid foundations of mutual trust and confidence.

Speculative buying of farms in many of the closely settled areas is prohibited by a system of supervision on all sales of farms, and this has the healthy effect of preventing over-capitalisation of farms.

Agricultural Extension: The organisations responsible for the advancement of farming in all its phases are far too many to mention in detail. The Department of Agriculture is highly organised in each state and it works in the same way as its counterpart in India, except that the Australian Department has, by the confidence reposed on it by the farmers, become a force to be reckoned with while handling any rural problems. The Department works in close liaison with C. S. I. R. O. and Universities who initiate works of fundamental importance. Because of the smaller number of farmers to deal with, the staff of the department know each farmer personally and this leads to better understanding of mutal problems. In certain areas like the Murrumbidgee Irrigation areas or in certain industries like the sugar industry, the farmers are under the immediate guidance of special agencies like the Water Conservation & Irrigation Commission or the Bureau of Sugar Experiment Stations.

Commercial Specialist Services to carry out engineering works like levelling and to supply pedigree seeds and pedigree stud animals, insecticides, fungicides, and, infact, every requirement of the farmer are found in every corner of the country and the Department of Agriculture is not bothered with this sort of service.

The Farmers' organisations are scattered throughout the country. They have sprung up from among the farming public and are well patronised by them. They have regular meetings in which they discuss their problems, exchange notes and submit their considered views and demands to the proper quarters. Each centre of population has got its own show ground, often owned by the farmers' organisation, where the local Agricultural Society holds its annual exhibition and awards prizes to the winners in the competitions. The agricultural Clubs, the Farmers' & Settlers' Association and other similar organisations are the watchdogs of the interests of the farmers and they issue weekly and monthly journals for the benefit of the farmers. The Royal Agricultural Societies are the premier organisations and they have as their object, the exhibition of agricultural, livestock and other products of individual States and to conduct contests in agricultural production in different parts of the State. The Royal Easter show conducted by the Royal Agricultural Society of N. S. W. is truly the greatest show on earth, where, in 1956, 20,000 pedigree livestock and 900 agricultural and livestock products were exhibited. About a million people were estimated to have visited the shows and the prize money given away to prize winning exhibits amounted to £ 30,000/. The Department of Agriculture lends the services of its staff for judging the exhibits.

The stock of the farmer in the public life is very high and his influence in the Government of the day is immense.

Agricultural Production: Volume of agricultural production is neither controlled nor under any restrictive practices, except in the case of sugarcane and, to a lesser extent, in case of rice. But the marketing of all commodities is controlled by various Marketing Boards constituted under the Marketing of Primary Products Act. A singular exception is wool which is sold in the free markets by public auctions. Representatives of producers have an effective voice in these boards and it is this body which is responsible for laying down standards of production, fixing up local and export prices and ensuring the orderly marketing of the products. The Commonwealth Bureau of Agricultural Economics carries out surveys of cost of production of various commodities and, based on its reports, the Commonwealth Government grants subsidies from out the general revenues in suitable cases. The whole aim is to prevent the exploitation of farmers by middle men, stabilise the prices of agricultural commodities on a scale of parity with the cost of industrial goods and ensure the farmer a decent standard of living.

The system of giving Income-Tax rebates and depreciation allowances to investments made in farms are intended to attract sufficient capital to the rural areas.

The action taken be the farmers themselves in organising gigantic Co-operatives for the processing of their products—Ardmony Coop. Canery, Leeton Co-op. Cannery, the Rice Growers' Co-op. Mills and various butter factories—and for supply of their requirements at reasonable cost, has the effect of ensuring to the farmer a fair deal in all his transactions. These co-operatives, it must be understood, have sprung from below and not super-imposed on the farmers by any Government agency.

Rice Hispa (Hispa Armigera Ol.)

by

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Introduction: Rice Hispa *(Hispa armigera* Ol.*)* is one of the major pests of Rice crop in the Hyderabad State causing an average loss of 10% in yield. Occurring on both the seasonal crops, the winter sown crop, known as *Tabi,* planted in December–January is more attacked than the monsoon crop known as *Abi,* sown during the months of June–July. In years when the south-west monsoon rains are late, *Abi* crop also is damaged to a very considerable extent. In Hyderabad State the pest is found in all the rice growing districts. It is locally called "*Nalla Purugu*" (Black Insect). The annual average infestation of Rice Hispa is 15,000 acres on an area of14.5 lakhs of acres grown in the State.

Padwick (1948) in his review on Plant Protection and Food crops in India mentions that in 1946, Rice Hispa caused a heavy loss on 20,000 acres of Rice crop in Madhya Pradesh. Trehan and

Pingle (1946) reports that it is a major pest in Karwar and Belgaum districts of Bombay State and that both the *Kharif* and *Rabi* crops of paddy are damaged. It is also a serious pest of rice crop in Assam, West Bengal, Bihar, Orissa and Madras States. Outside the Indian sub continent, it is a serious pest of rice crop in China (Chu, 1938) and Formosa (Shen and Kung, 1954).

Description: Rice Hispa belongs to the genus Hispa, sub-family Hispinae, Family Chrysomelidae, of the natural order Coleoptera. The body of the insect is oblong and shining, blue-black in colour. On each side of the thorax four long spines are found which originate from a common base and a fifth separate posterior one which is smaller. The elytra is also oblong and armed with a number of strong erect spines. The adult female beetles are on an average 4.7 mm long and 1.97 mm broad, whereas the corresponding figures for the male beetles are 3.7 mm and 1.7 mm. The adult beetles can fly long distances mostly in the direction of the wind. They usually fly in the evening hours and are observed in large numbers on the plants in the morning hours.

Nature of Damage and Loss Caused to the Crop: The damage to the rice crop is done by both the adult beetles and the grubs. The adult beetles scrape the leaves and devour the mesophyll while the upper and lower epidermis are not touched. In cases of severe infestation the leaves wither and dry up. In large fields of 50–60 acres extent, the infestation is found in patches in the centre of the field. These affected patches present a bowl-like depression due to the stunted growth of the crop. These 'bowls' act as foci for further infestation.

Infestation in the field not being uniform in all places, great difficulty is experienced in the estimation of loss in yield caused by the Rice Hispa. Sweeps with a hand net of 18" diameter have shown that the population in *Abi* season varies from 3–4 beetles per sweep wheras in *Tabi* it varies from 14–16 beetles per sweep. The population of adult beetles per plant in the transplanted crop varies from 25–30 beetles in cases of severe infestation. To determine the injury caused to the paddy plants, detailed observations have been made on the individual plants in both the affected and healthy patches of the same field, all the other set of crop conditions being uniform for both. Records have been taken of the number of culms per clump, average height of

the culms, length of panicles and numbers of sound and abortive panicles. The details are shown in the Table I.

TABLE I.

Table showing the Individual Plant Characteristics of Hispa affected and unaffected Paddy Plants.

Type of clump	No. of culms per clump	Average height of clump	Average No. of sound panicles	Average No. of abortive panicles
	VARIETY:	Banswadalu	LOCALITY:	Bodhan
Healthy	3.7	2′ – 6″	3.0	0.8
Very severely infested with hispa	1.4	1′ – 10″	—	9.8
	VARIETY:	HR. 35	LOCALITY:	Bodhan
Healthy	3.9	5′ – 0″	2.8	0.2
Hispa affected	1.4	4′ – 2″	1.2	0.6
	VARIETY:	Rajagarkal	LOCALITY:	Bodhan
Healthy	3.0	4′ – 1″	1.7	0.3
Hispa affected	2.2	4′ – 1″	1.7	0.3

It will be seen from the table that the main effect of injury by Hispa is on tiller formation and also on the formation of the panicles. The maturity of most of the culms in affected plants is delayed.

To determine the loss in yield of paddy due to Hispa infestation, records of the average yields obtained from the individual cultivators during the years of heavy hispa infestation and during normal years when there has been no hispa attack are given below. The crop under study was the *Tabi* crop sown in December-January. The data recorded is given in Table II.

TABLE II.

Table showing the average yields obtained during the years of severe Hispa infestation and during normal years (Hispa free).

Name of cultivator	Normal average yield in the per acre	Average yield when heavily attacked by Hispa in lbs. per acre
1. Korna Bhoomanna	1,600	500
2. Begari Sayiga	1,840	1,120
3. Magdonm Saheb	1,840	800
4. Lacchi	1,200	640
5. Sadasivam	2,400	1,280

From the table it will be seen that there is a reduction in yield ranging from 39–65%.

Seasonal History: After the harvest of the *Tabi* crop in May, stray adult beetles are observed on the sprouted stubbles and the early nurseries raised for the transplantation of the *Abi* crop in June. The first brood adults emerge by 3rd week of July and spread over to the neighbouring fields. The 2nd brood adults emerge by 3rd week of August. This brood is the most widespread and destructive especially if the rainfall is not normal, the attack continues up to end of September. Stray adults of the 3rd brood migrate by 2nd week of December to sprouted stubble and *Tabi* nurseries. The 4th brood adults emerge by last week of January and spread over to neighbouring fields. The 5th brood emerge by the 3rd week of February, and is very widespread and destructive to the *Tabi* crop. By last week of March the 6th brood adults emerge but the damage is negligible as the crop is advanced in maturity.

Eggs are laid in the leaf tip which hatch out in about a week's time. The grub stage lasts for 15 – 20 days, the grub feeding throughout in the same leaf mines and has never been observed crawling to other leaves as reported by Logothetis (1951). When two or more grubs attack a single leaf the different mines often coalesce into one. Pupation takes place inside the leaf mine between the two epidermal layers of the leaf and lasts for 6 – 10 days. The adult beetles in confinement have a longevity of a week to ten days. The complete life cycle occupies 30 – 35 days and does not vary much from year to year.

Natural Enemies: Logothetis *(Loc. cit)* in reviewing the information available on Rice Hispa does not mention of any natural enemies noted on it. In Hyderabad State the following parasites have been recorded.

(1) *Bracon* Sp. *(Braconidae: Hymenoptera)* – Larval parasite.

(2) *Eupteromalus* Sp. nr *nidulans* Forst. *(Chalcidoidea: (Pteromalus)* – mostly a secondary parasite on *Bracon* Sp. and sometimes a primary larval parasite on hispa grub.

(3) An unidentified *Cecidomyiid* larval parasite.

A brief account of *Bracon* Sp. has already been given by Khan and Murthy (1954.) Detailed observations have shown that the incidence of parasitism ranges from 15% to 82%. The parasite appears very promising and its potentialities have been observed in Bodhan Taluka of the Nizamabad district which used to be an endemic area of hispa infestation formerly. It may be mentioned that since the past three years, Rice Hispa has never been observed in a pest form in Bodhan Taluka. *Bracon* Sp. however, has the following two hyperparasites, which exercise a considerable check on it.

(1) *Dimmockia* Sp.
(2) *Achrysocharis cardigaster* Masi } *(Chalcidoidea: Eulophidae)*

Control Measures: A number of remedies have so far been tried for the control of this insect pest. While it could be easily controlled in nurseries, it is more difficult when once the pest spread to the transplanted crop. Amongst the methods of control tried against the pest were bagging of adult beetles by hand nets and clipping of affected leaves. Clipping of affected leaves, although effective at the time of transplanting, is not favoured by the local cultivator who fears a set back in growth and yield of the crop which, however is not the case.

Amongst the earlier chemical methods experimented, spraying with Lead Arsenate deserves mention. Lead Arsenate spraying @ one oz. per gallon of water was found quite effective comparing well with DDT. But spraying with Lead Arsenate and DDT was found very tedious and also costly, the cost of the Chemical itself amounting to 7–8 Rupees per acre for each spraying. Further. the area that could be covered was also considerably less. In view of the above, the need of a satisfactory insecticidal dust was felt. Both BHC and 'Pyrodust' were experimented with and found equally effective. However, BHC is found more economical. Uptill now, an area of over 50,000 acres of paddy has been dusted with BHC 5% dust against hispa attack.

While passing it may be pointed out that while in earlier years 10–12 lbs of BHC 5% dust was effectively controlling this insect pest, of late, it has ceen found essential to increase the dosage to more than 15 lbs per acre in endemic areas where dusting is being carried out season after season by the Plant Protection Organisation. The biological assay results show that there has

been no loss in the potency of the insecticide. It appears that the pest is slowly gaining a perceptible resistance to the insecticide, which, however remains further to be investigated.

Summary: Hispa (*Hispa armigera*, Oliver) is one of the major pests of Rice crop in Hyderabad. It is observed on both the 1st and 2nd crops in the Telengana area but the damage is more on the 2nd crop. The main effect of injury is on the formation of culms and also the delay in normal emergence of panicles thus contributing to low yields. Three larvel parasites have been observed of which *Bracon* Sp. *(Braconidae: Hymenoptera)* appears very effective. Amongst the control measures tested and adopted on a large scale is the dusting of BHC 5%, Brief notes on the biology and seasonal history are given.

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Some Facts about Arecanut

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Introduction: Arecanut is grown in India, under varied conditions of soil, climate and altitude and it is needless to say that its agriculture is also carried out in diversified methods and practices. Hence it is difficult to generalise on the method of cultivation of the crop. But it is the duty of scientific workers, especially at this hour, when maximum production per unit of labour and soil is aimed at, to find out the best and most economic method of cultivation of this crop. The attempts made at the Arecanut Research Station at Vittal of South Kanara along the above lines are described in this paper. The Arecanut Research Station at Vittal comprises 4·75 acres of garden taken on lease and has the conditions of semi-malnad parts of South Kanara. The work of the station is primarily on the pathological aspects of the areca palms but work was also carried out, side by side, on other lines such as agronomical and certain fundamental facts also. The age of the garden is about 34 years.

Details of work: The cultivation practices that are followed at this station are described below:

Seeds and sowing: With a view to select trees of very high performance, the yields obtained from all the palms in the garden are recorded separately with full details of number of bunches harvested, number of nuts per bunch, weight, size, shape and colour of nuts etc. Seed nuts are selected from trees which are high yielders and healthy. Care is also taken to follow the methods of selecting seed nuts that are locally adopted, such as harvesting middle portions of bunches, nuts which are medium sized etc. The methods of raising seedlings are also those followed locally, viz. dibbling small sprouts which were allowed to germinate in baskets or straw bundles. Seedlings of $1\frac{1}{2}$ to $2\frac{1}{2}$ years of age are used for planting in the main field. The cost of raising such seedlings comes to about 9 pies to an anna per seedling.

Planting: At the Arecanut Research Station, the seedlings are planted wherever gaps are formed by the mortality of the palms due to various causes. The stumps of dead areca trees are

dug out and pits $3' \times 3' \times 3'$ are formed. The pits are refilled to a height of about one foot from their bottom level. Care is taken to see that refilling is done in such a manner as to form a cone of earth at the centre of the pit. Then the seedling which is removed from the nursery with a ball of earth is placed over the cone so formed and some more earth is added and the plant is firmly fixed to the soil by pressing the sides of the cone. The formation of cone and planting the seedling prevents stagnation of water at tne collar region of the plant facilitating its early establishment. No manure is added while planting, except spreading some green leaf round the base of the seedling to prevent the soil splashing to the tender spindle during heavy rains. About a fortnight after planting they are manured with cattle manure or compost and ash. Planting is usually done either in the begining or end of August. But it has been the experience that they can be planted during other months also if good irrigation and drainage facilities are available.

Leaf-fall and Flowering: Under best conditions, the palm is said to flower in about 4 to 5 years after planting, though normally it takes about 6 to 8 years. Flowering is seen throughout the year but the peak period is between the months of November and April which is evidenced by the following table:

TABLE I

Number of spadices produced during 1954 - '55 at the Research Station, Vittal

Month	Number of inflorescences developed in 1953 — '54	Number of inflorescences developed during 1954 — '55	Average	Percentage of the total production in the month
July	52	150	101·0	1·5
August	36	137	86·5	1·3
September	83	154	118·5	1·9
October	182	390	286·0	4·5
November	342	763	552·5	8·3
December	533	824	678·5	10·3
January	646	1451	1048·5	16·0
February	816	1310	1063·0	16·2
March	948	1301	1124·5	17·1
April	854	878	866·0	13·2
May	685	298	491·5	7·5
June	228	68	148·0	2·3
Total	5405	7724	6564·5	100·0

TABLE II

Average number of leaves shed and the number of inflorescences developed during the years 1953 - '54 and 1954 – '55

Month	Average number of leaves shed from 1575 trees	Average number of inflorescences developed in 1575 trees	Percentage of inflorescences to the leaf-fall
1 July	549·5	101·0	18·5
2 August	543·5	86·5	15·9
3 September	541·5	118·5	21·9
4 October	871·5	286·0	32·8
5 November	1014·0	552·5	54·5
6 December	891·5	678·5	76·1
7 January	1205·5	1048 5	87 0
8 February	1208·5	1063·0	88·0
9 March	1206·5	1124·5	93·2
10 April	1006·0	866·0	86·1
11 May	851·0	491.5	57·8
12 June	611·5	148·0	24·2
Total	10500·5	6564·5	62·5

Even though the leaf-fall is seen during all the months of the year, yet the percentage of inflorescences to the leaf-fall is observed to be more during the months of October to May than in other months (as evidenced in table II above) and more than 80% of the inflorescence is developed during the months of November to April (as is evidenced in table I). The average number of leaves shed per palm per year was recorded to be 6·7 and the number of inflorecences produced was only 4·2.

After cultivation: This consists of weeding whenever found necessary, digging to about 6 to 8 inches deep with mammuti fork during the month of November and attending to the general cleanliness of the farm by picking 'sogais' (dry leaves) and removing dead inflorescences etc. Another important operation that is included under after-cultivation is the spraying of areca bunches against Fruit-rot or Kolesoga with 1% Bordeaux mixture twice during a year, once towards end of May or early June and for a second time during the middle of July. The tender palms are protected by tying areca leaf-sheaths or leaves over them which helps to minimise

the sunscorch of stems. The life of older trees with cavities or fissures can be prolonged by tying split pieces of areca stems over such portions.

Manurial Practices: The method of manuring adopted at the station was slightly different from that which is generally practised by local growers. The manure is applied in a circular trench 1 foot wide and 9″–10″ inches deep, dug 2 feet away from the base of the tree. Half a pound of Superphosphate per tree is spread at the bottom and over this 20 lb each of green leaf and 20 lb of cattle manure or compost is spread and $1\frac{1}{2}$ lb of wood ash is also applied at the top layer and the manures are finally covered up with earth. Manuring is usually taken up during August of every year. Compost required for the farm was prepared from materials available in the farm itself such as dry leaves of areca, banana and other farm rubbish.

Attempts were also made to make the farm self-sufficient with respect to its green manure requirements. For this purpose plants of *Gliricidia maculuta* and *Indigofera teysmanni* were planted in the marginal areas of the garden. Gliricidia was also planted as a hedge crop on the fence line of the garden which gave a good portion of the green leaf requirement of the station. Besides these, cover crops such as *Peuraria javanica*, *Centrosema pubescens* and *Calopogoninm mucunoides* were tried with success. Seeds of the above cover crops are sown in between rows of areca trees during the month of January. The advantages of sowing the seeds during January are as follows:

(1) The crop gets itself well established before the beating South-West monsoon rains commence in June or July. (2) the crop gives good protection to the surface of the ground from the direct rays of sun during the summer months. (3) the crop prevents the surface erosion of manurial ingredients during the rainy season. (4) it improves the texture of the soil and finally a good green manure crop becomes available at the month of August for manuring.

Irrigation: The garden needs to be irrigated from the middle of November to the end of May or till the onset of South-West monsoon rains. The tanks and irrigation channels are to be rectified during October and November. Water is let in through the channels from the middle of November or early December and

splashed to the surface of the garden by using a small bucket made out of the leaf sheath of areca. Irrigation is given once in 5 ar 6 days.

Harvesting and curing: (a) Nuts are harvested when they are fully mature i.e. when they change to orange red or yellow or crimson in colour. The bunch becomes ready for harvest on an average, after eleven months of the leaf-fall and appearence of inflorescence, though the period varies from 9 1/3 months to 13¾ months (as is evidenced in table III given below).

TABLE III

Showing the dates of appearance of inforescence and harvesting of bunch.

Tree No.	Date of leaf-fall or appearance of spadix.	Date of harvest or ripe bunches.	Period taken for maturity in months and days.
1	14—4—1954	10—3—1955	10 months - 27 days.
	28—5—'54	1—4—'55	10 ,, 3 ,,
2	13—1—'54	21-12—'54	11 ,, 8 ,,
	3—3—'54	18—1—'55	10 ,, 15 ,,
	4—4—'54	17—2—'55	10 ,, 13 ,,
	8—5—'54	10—3—'55	10 ,, 2 ,,
3	13—1—'54	17-11—'54	10 ,, 4 ,,
	8—3—'54	19—1—'55	10 ,, 11 ,,
	30—3—'54	18—2—'55	10 ,, 16 ,,
	10—5—'54	10—3—'55	10 ,, 0 ,,
4	22—9—'53	18-11—'54	13 ,, 26 ,,
	22-10—'53	18-11—'54	12 ,, 26 ,,
	27-12—'53	22-12—'54	11 ,, 26 ,,
	7—2—'54	20—1—'55	11 ,, 13 ,,
	14—3—'54	18—2—'55	11 ,, 4 ,,
5	17-11—'53	18-11—'54	12 ,, 1 ,,
	25-12—'53	23-12—'54	11 ,, 29 ,,
	6—3—'54	20—1—'55	10 ,, 14 ,,
	10—5—'54	19—2—'55	9 ,, 9 ,,

(b) *Size and shape of nuts:* The size and shape of nuts are found to vary within the same bunch and in different bunches of the same tree. The length of nuts varies from 3.2 cms to 6.8 cms.

and breadth (at the widest point) from 2.9 cms to 5.3 cms. Different shapes viz. oval, oblong, spherical and pyriform are also seen, but colour is a more or less consistent factor for fruits of individual trees.

(c) *Period of harvest:* Harvesting of ripe arecanuts is done in almost all the months, but the bulk or major harvests are made between October and March. During other months only stray bunches become available for harvest. The percentage of the number of nuts harvested at each month to the total harvest of the year at the Research Station, Vittal is given below:

TABLE IV

Percentage of total for the year.

S. No.	Month	1953—'54	1954—'55	Average
1.	July	0·10	0·04	0·07
2.	August	0·65	0·30	0·48
3.	September	1·35	1·25	1·30
4.	October	9·52	1·87	5·70
5.	November	12·94	16·20	14·57
6.	December	20·06	34·79	27·42
7.	January	35·10	24·83	29·97
8.	February	15·10	15·42	15·26
9.	March	4·90	4·01	4·45
10.	April	0·19	1·16	0·67
11.	May	..	0·13	0·06
12.	June	0·09	..	0·05
	Total ..	100·00	100·00	100·00

From the above table it is also gathered that more than 87% of the total produce is harvested between November and February.

(d) *Curing of arecanuts:* The ripe arecanuts are harvested from the trees by using bamboo poles. After harvest the nuts are spread in the sun for drying in the specially prepared curing yards. They are allowed to dry in the sun for about 35 to 40 days. To ensure uniform drying and easy separation of kernel from husk, the fruits are turned upsidedown once in 3 days. They are then husked by using special knives called 'Mettukathies' and sorted. The

superior nuts form the 'Billigotu' portion and the inferior ones are separated as 'Koka'. The relation between the nuts at different stages of curing is furnished in table V.

TABLE V

S. No.	Particulars	1952-53	1953-54	1954-55	Average
1.	Average number of fruits (wet) per lb.	14	14	13	13.7 or 14.0
2.	Average number of dry nuts (with husk) per lb.	35.5	35.2	34.2	35.0
3.	Percentage of drying (after 40 days of drying)	59.7	59.9	62.2	60.6
4.	Average number of cured and husked nuts per lb.	59.0	57.7	57.2	58.0
5.	Percentage of 'Koka' in husked nuts by weight	3.7	4.5	3.2	3.8
6.	Percentage of husked nuts over total wet weight of nuts	23.5	24.4	22.5	23.5
7.	Percentage of husked nuts over dry weight (nuts with husk)	58.3	60.9	59.7	60.0

From the above table it is estimated that on an average 100 pounds of fruits give after drying, 39.4 lb. of dried areca, which, after dehusking, given 15.9 lb. of husk and *23.5* lb. of husked nuts of which 0.9 lb. will be 'Koka' and 22.6 lb. will be 'Biligotu'.

(e) *Yield:* The average yield per acre of the garden (with only 338 bearing trees per acre) was 1,132 pounds of cured and husked nuts. The details regarding the yields per tree of bearing age recorded at the Research Station during the last three years is given below:

TABLE VI

Average yield per Tree.

S. No.	Particulars	1952-53	1953-54	1954-55	Average
1.	Average number of bunches per palm	2.2	2.4	2.9	2.5
2.	Average number of fruits per bunch	96.0	68.7	72.5	79.0
3.	Average yield of arecanuts with husk per palm (Nos.)	208.0	164.9	210.0	194.0
		lb.	lb.	lb.	lb.
4.	Average yield (cured and husked nuts) per palm by weight	3.5	2.8	3.6	3.3

From the foregoing figures it is gathered that only 2.5 bunches per palm are available for harvest even though the spadices produced is 4.2 and the average under of leaves shed is 6.7 per palm per year. Hence it is evident that 37.3% of the leaves that shed are barren without spadices and out of the 62.7% which produce spadices 25.4% are infertile spadices and get dried up and only 37.3% of the spadices get fertilised and develop into good bunches.

Subsidiary Crops: Several subsidiary crops like coconuts, banana, pine apples, peppervines etc. are grown primarily with the object of providing shade to the garden and also to increase the revenue.

Summary: The method of raising arecanut varies from tract to tract. One such method as followed at the Arecanut Research Station, Vittal, is explained in detail. An attempt has also been made in this paper to record the various foundamental facts and figures gathered at the above mentioned Station during its 3 years of existance.

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Research Note

Observations on Germination of Dry Seed Coconuts

Coconut is a perennial palm which is seed-propagated. The fruit of the palm is itself the seed when mature. The fruit is botanically a drupe. It consists of a hard, leathery epicarp, a fibrous mesocarp and a hard, stony endocarp called "the shell" of the husked nut, which encloses the seed. The seed itself is made up of an endosperm which lines the entire inner surface of the shell and is one centimeter or more in thickness in a normal fully matured nut of the ordinary tall variety of coconut. The embryo which is small and somewhat button-shaped lies embedded in a small cavity within the endosperm, towards the stalk end of the nut. There is a single cotyledon which is situated just below the embryo. The endosperm which is popularly known as the kernel is sweet and forms the edible part of the nut generally containing about 60 to 75 percent of oil. It is this oil in the endosperm that is utilised by the germinating nut for the development of the seedling. The endosperm encloses a cavity which contains a sweet water popularly known as "Milk". This liquid practically fills up the entire cavity in the early stages of development of the nut, but later gets reduced in quantity as the nut matures. Generally in a fully matured nut (11 or 12 months old), the water gets reduced to fill up nearly half the cavity. If such nuts are stored for a long time (say for more than 2 or 3 months) after harvest, the water inside them gets reduced rapidly especially during hot weather. The water content can however be kept up without any appreciable reduction in volume for a longer period (say about 6 to 8 months) if the nuts are carefully preserved in sand. It may thus be seen that the seed of the coconut is different from that of the other plants in that it is hollow inside and contains a liquid which should be present in sufficient quantity for the proper germination of the nuts. The role of this water in the germination of the nut has not, however, been investigated. But it has been reported by some workers that it has the capacity to hasten the germination of certain seeds kept soaked in it. The water in the mature nut contains about 2 percent sugars consisting mainly of reducing sugars and sucrose.

Experiment: In 1953, as a measure of rehabilitation, about a lakh of seed coconuts were procured from the gardens on the West Coast for supply to the growers in the cyclone devastated areas in

Tanjore district. During storage of these seed nuts at the distribution centres a large number of them became completely dried up (without any water inside) rendering them unsuitable for planting to raise seedlings.

An observational trial was conducted in the coconut nursery at the Agricultural Research Station, Pattukottai in 1953, to study the germination of these dry nuts in comparison with those of normal nuts. One hundred seednuts witn sufficient quantity of water and a large number of dry nuts (without any water inside) were soaked in water for a week. The soaking was done by immersing the nuts in rectangular pits ($10' \times 4' \times 4'$) filled with water. Among the dry nuts soaked, some were found to have become heavy due to absorption of water while others remaind light. One hundred nuts were selected at random from each of the 'heavy' and 'light' groups and planted in the nursery along with the 100 normal nuts. The planting was done on 17th September, 1953. The germination of the nuts under each lot was recorded. Most of the seednuts in the different groups germinated within 4½ months after planting. The percentages of germination are as given below:

Treatments.	*Percentage of germination.*
(1) Nuts with water (normal)	93
(2) Drv nuts (heavy after soaking)	64
(3) Dry nuts (light after soaking)	31

From the figures furnished it would be clear that the drying up of the water ('Milk') affects the germination of nuts considerably. As against 93 percent germination recorded by the normal nuts, only 64 percent and 31 percent were recorded by the two groups of dry nuts. However, it shows the possibility of germinating even the "dry" nuts by soaking them in water, provided the water in the nut has just then dried up, as this was the condition of dry nuts used in the present evperiment. Yet another conclusion that can be drawn from this study is that the dry nuts which absorb a large quantity of water and thereby become heavy after soaking is capable of giving a higher percentage of germination than those which remain "light" after soaking. Further it was observed that the seedlings raised from them are in no way inferior to those obtained from the normal nuts. Selection of seedlings on the basis of established criteria is also necessary in their case as is usually done.

In nursery practice it is usually to reject all the seednuts which are found without water at the time of planting them in the seedbeds. But from the present experiment it appears possible to utilise some of them for producing seedlings by soaking them in water for a week and selecting only those which become heavy after the treatment. This is an important and useful hint to nursery men who produce quality seedlings for supply to coconut growers and who are likely to discard 'dry' seed nuts altogether from planting.

Agricultural College & Research Institute, Lawley Road P. O. 30th April, 1956.

S. G. AIYADURAI,
Assistant Oilseeds Specialist.

Gleanings

Mould Board Plough: Gives better puddle: The mould board plough is more advantageous to work in rice fields in swampy conditions. In trials conducted in Madras State, the mould board plough was compared with the wooden plough under wet land conditions. Two sets of adjoining fields, identical in all respects, were used for the trials. In one set, an iron plough was used. All operations such as manuring, sowing, planting, weeding and harvesting were done simultaneously in the two sets of fields. The number of ploughings given to each set was restricted to four.

It was found that in the fields where the iron plough was used the yield increased from 4 to 9 per cent. This is probably because of the better puddle obtained. The inversion of the soil and the burial of weeds and stubbles were most satisfactory in the fields where the iron plough was used. To get a similar puddle with a wooden plough more ploughings would have been necessary. But this would have added to the cost of operations. — ICAR

Plough injury to animals: First Aid: Many a time, while ploughing, the iron point of the plough injures the back of the fetlock of the hind limbs of the bullocks. Farmers tend to neglect this, as a result of which dung, clay and dust particles enter the wound and infection (sepsis) sets in. Because of inflammation, swelling develops above the fetlock. The animal becomes lame and unfit for work. The plough injury should receive prompt attention of the farmer. If neglected, the animal will not be fit for work for a long time. Immediately any injury to the limb is noticed, it is better to take the animal out of the field, and wash the wound with a dilute phenyl or permanganate lotion. Thereafter, the wound should be well covered by a temporary bandage consisting of a clean piece

of cloth. The animal can then be walked to the nearest veterinary hospital for treatment. With proper treatment, the animal can be fit for work again in a short time. — ICAR

Small-sized Coconuts: Convert them into ball-copra: It is better to convert the small-sized coconuts harvested during the rainy season into ball copra. The conversion of the nuts into the ordinary copra during the rains is not easy, and hence the grower sells these nuts at low prices. But, if the nuts are stored in lofts on raised platforms and exposed to smoke, ball copra can be obtained in due course. Ball-copra fetches a premium in the North Indian Markets. — ICAR

Storing Potatoes — Reserve Well in Cold Storage: Results of cold storage trials with potatoes in Bombay State show that potatoes can be preserved in good condition for more than a year at 35°F. But at this temperature, the tubers gradually become sweet and lose their value as table potatoes. But, if they are kept at 40°F, it is possible to store them for about nine months without fear of their losing table quality. The seed value is not affected by cold storage either at 35°F or 40°F for the periods shown above. — ICAR

Nagpur Orange — Cold Storage Trials: Cold storage trials conducted in Bombay State with Nagpur oranges or *santras* show that it is possible to keep fully ripe yellow fruits in good marketable condition for 3 months by storing them at 40°F. During storage the taste of the fruits remains practically unaltered. If the oranges are carefully selected before storing and all injured fruits rejected. very little loss of fruit occurs in storage. The Mosambi is best stored at 42°F. The appearance and quality of the juice improve in cold storage. Malta oranges and *kagadi* limes can be stored in good condition for four months and two months at 40°F and 52°F respectively. — ICAR

Hybrid Coconut Seedlings — Good Performance: Coconut-growers can now have a coconut palm that combines the good qualities of both the tall and dwarf palms. The tall type of palm gives high yields with large nuts and superior quality copra. But it bears late. The dwarf palm, on the other hand, begins to bear early, but the nut and copra contents are inferior. Hybrid seedlings of the tall and the dwarf type of coconuts have been found to bear early like the dwarf and have the good nut and copra qualities of the tall. A small number of these hybrid seedlings are now being produced at the Central Coconut Research Station, Kasargod and the Agricultural Research Station, Nileshwar (Madras State) for supply to coconut-growers. — ICAR

Some observations on growth and yield of potatoes raised on bench terraces at the Agricultural Research Station, Nanjanad: An extent of 80 acres of cultivated slopes at the Agricultural Research Station, Nanjanad, was progressively bench-terraced during the years 1954 and 1955, to effect soil conservation measures. In the main crop season of 1955, an area of 10·89 acres of potatoes was planted in the newly terraced blocks and another 12·54 acres in the old slopy area. The mean acre yields of tubers were as follows:

Terraces	..	11,441 lb.
Slopes	..	9,554 lb.

A marked increases in the yield of tubers, amounting to 1,887 lb. (about 9 bags, valued at Rs. 225/- per acre at Rs. 25/- per bag of 200 lb.) was obtained even in the first year of cropping after terracing.

It was initially felt that the first crop taken immediately after terracing would be below normal, due to the mass displacement of the old top soil and the need for the new top soil to get weathered and mellow in course of time and after a season or two of cropping. But, the yield values as above, have clearly indicated that conservation of soil, moisture and the fertilisers against wash-down as a result of terracing had off-set the expected shortcomings of the fresh soil on the terraces.

Another general observation was that while the soil in the slopy blocks particularly on the tops, tended to dry up appreciably in dry spells, the benches continued to remain moist for longer periods. This advantage of better retention of moisture over the terrace was clearly reflected in the plant growth, the development of which were more vigorous than that of the crop raised over the slopes. — (MANL)

Improvement of the keeping quality of Ghee: Although ghee is one of the most stable dairy products of the tropics, it undergoes deterioration both in market quality and nutritional value due to the prevailing high temperature, exposure to air and light, and various other environmental conditions besides improper methods of manufacture and storage of butter prior to the preparation of ghee. Studies carried out at the Agricultural Research Institute, Coimbatore show that ghee of good keeping quality can be prepared directly from cream by re-separating the sweet cream obtained from milk (after mixing it with five times its weight of water), ripening the re-separated cream to 0·15% acidity (as lactic acid) and melting the ripened product at 135°C.

Certain plant materials and chemicals were found to impart a higher keeping quality to ghee. Addition of 0·5% curry leaf (Murraya Koenigi) towards the close of melting markedly enhanced its storage life. A petroleum ether extract prepared from the alcohol soluble portion of the leaf had powerful antioxidant effect when added at 0·05% level. Carbohydrate materials like cane, palmirah and coconut jaggeries also improved ghee by reducing the acidity when added at 0·85% towards the end of the melting. Chemical antioxidants like N. D. G. A., propylgallate, when added at 0·02% level to the prepared ghee were also useful in preventing the deterioration for a considerable length of time. A mixture of propylgallate and butylated hydroxy anisole (at 0·01% each) had a very good preservative effect. The action of the chemical antioxidants was enhanced by the addition of citric acid (at 0·01% level).

Vacuum packing appeared to be the best form of packing ghee when intended or long storage. — (MANL)

Blackarm Disease in Karunganni Cotton: At the Agricultural Research Station, Koilpatti, incidence of blackarm was noticed during the year 1955–'56 in the one month old Karunganni Cotton Crop. Examination made on the crops located in the elevated and low lying areas indicated that the attack was more in the latter case where the plants were subjected to stress of excess moisture causing poor growth. (MANL)

Cultivation of P. 216 F Cotton in Rice Fallows: P. 216 F cotton raised during the year 1954 and 1955 at the Agricultural Research Station, Aduthurai and Coimbatore, representing the deltaic and non-deltaic rice fallows, respectively, registered 270 and 462 lb. of lint per acre. The samples of Aduthurai were adjudged to spin 41's while those of Coimbatore to 34's. The cash return per acre at Aduthurai and Coimbatore was Rs. 366/- and Rs. 648/- and the cost of cultivation was estimated at about Rs. 250/- and Rs. 350/- respectively. (MANL)

The Jassid and the Fulgorid pests of paddy: Among the more important pests of paddy, the green jassid–*Nephotetix bipunctatus* and the fulgorid *Nilaparvata lugens* deserve special mention. These hoppers have been noted to assume serious proportions during recent years, particularly on the kuruvai crop, in the Tanjore delta. Research on the bionomics and control of these pests has been in progress at the Agricultural Research Station, Aduthurai for the past three years (1953–'55). The jassid and the fulgorid may occur independently or in association with each other. They lay other eggs inside the leaf sheath. The eggs hatch out in about five to six days & one completed life cycle occupies 24 days in the case of the former and 20 days in the case of the latter. Generally three to five broods occur during the crop season. The jassid usually makes its appearance soon after transplantation and continues to infect the crop till harvest. The fulgorid on the other hand, restricts its activity mostly to the later stages of the crop. Fields showing water stagnatian and a consequent lodging of the crop offer ideal situation for the rapid multiplication of this hopper. Both these hoppers suck up the plant sap, causing varying degrees of stunted growth, premature yellowing and comparatively weak earheads. The damage is serious, if the infectation manifest itself at the shot blade stage of the crop. The earheads are rendered chaffy and the yield is affected. Amongst the two hoppers, the fulgorid is more serious.

Tne use of a mixture of DDT 5% dust and BHC 20% in equal proportions, has been found to give appreciable relief in controlling a combined infestation of the jassid and the fulgorid. With a view to find out a more efficient method of control, a fair trial was given to some of the newer formulations of pesticides. The variants comprised BHC, Taxaphene, Folidol, Indrin, and a mixture of DDT and BHC dusts. Quantitative data on the insect infestation as well as yield were gathered. Folidol spray (One ounce of Folidol E. 905 in 6¼ gallons of Water) applied twice. the first at the shot blade stage and the second at the milky stage of the ears, has given the best results as judged by a lowering of the pest incidents and on increase in yield. Similar treatments either with Taxaphene 20% dust or Endrin spray (one ounce of 19·5% emulsion in 12¼ gallons of water) took the next place in the other of efficiency.

It is thus evident that the use of two rounds of folidol spray or taxaphene 20% dust of endrin spray is a further improvement at the control measures previously adopted viz. dust of a mixture of DDT 5% and BCH 30% and may be adopted with advantage.

Activated Paddy Husk Increases Water Holding Capacity of Malabar Laterite Soil: In an effort to increase the water holding capacity of the highly porous laterite soils of Malabar, an experiment was conducted by the addition of 1% paddy husk charcoal (activated) to laterite soil and the water holding capacity estimated after allowing the soil to drain for twenty one hours. The results are as below:

	Untreated laterite Soil	Laterite soil mixed with 1% animal charcoal	Laterite soil mixed with 1% activated paddy husk
Water holding capacity	56·4%	60·2%	65·8%

With animal charcoal the increase in the water holding capacity is not significant but with paddy husk there is an increase of about 18% over the untreated soil.

(M A N L)

Weather Review — For August, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	8·0	+ 3·4	20·1
	Tirurkuppam*	8·7	+ 3·6	18·5
	Vellore	4·6	— 1·2	20·6
	Gudiyatham*	4·5	+ 0·5	14·9
East Coast	Palur*	7·0	+ 1·5	18·7
	Tindivanam*	8·9	+ 4·1	18·0
	Cuddalore	5·2	+ 0·4	14·5
	Nagapattinam	3·9	+ 0·8	10·5
	Aduthurai*	2·5	— 2·4	11·0
	Pattukottai*	3·7	— 0·8	11·9
Central	Salem	3·6	— 3·0	13·9
	Coimbatore (A. M. O.)*	1·3	£	9·1
	Coimbatore	2·6	+ 1·4	9·1
	Tiruchirapalli	2·0	— 2·1	5·9
South	Madurai	6·3	+ 2·2	12·4
	Pamban	Nil	— 0·6	2·2
	Koilpatti*	1·6	— 0·5	8·7
	Palayamcottai	2.0	+ 1·3	6·5
	Ambasamudram*	0·5	+ 0·1	7·5
West Coast	Trivandrum*	4·2	— 2·5	33·3
	Fort Cochin	9·3	— 4·7	92·5
	Pattambi*	10·6	— 2·6	67·2
	Kozhikode	12·6	— 4 5	98·0
	Taliparamba*	21·4	— 4·2	114·5
	Wynaad*	10·2	— 3·9	60·6
	Nileshwar*	15·9	—14·5	124·9
	Pilicode*	13·0	— 9·4	101·2
	Mangalore	18·3	— 7·2	123·3
	Kankanady*	18·0	— 6·9	126·4
	Kotekar*	18·6	— 5·9	@
Hills	Kodaikanal	7·1	— 0·1	25·2
	Coonoor*	2·5	— 0·9	15·4
	Ootacamund*	2·5	— 2·4	21·2
	Nanjanad*	3·6	— 3·7	27·5

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.

2. £ Actual Deviation is -0.04"

3. @ = It is a new station. The raingauge was installed in March 1956.

The month began with a shallow depression in the Northwest Bay of Bengal. In the first six days of the month Malabar and South Kanara had fairly widespread rains while the weather was mainly dry elsewhere with the exception of some scattered and localised showers in Travancore-Cochin on 2—8—56 and 3—8—56. On 7—8—56 rains were widespread in Malabar and South Kanara and scattered in Tamilnad. For three days from 8—8—1956 rains were fairly widespread in the West Coast and scattered in Tamilnad. There was a temporary break in the monsoon rains over the major part of the country on 11—8—56. For two days from 11—8—56 rains were fairly widespread in the West Coast and scattered elsewhere. On 13—8—1956 conditions became favourable for the strengthening of the monsoon along the West Coast. For three days from 13—8—1956 rains were fairly widespread in the West Coast and scattered in Tamilnad. Monsoon gained strength along and off Malabar Coast on 16—8—1956. For six days from 16—8—1956 rains were widespread in Malabar and South Kanara, fairly so in Travancore-Cochin and scattered and localised in Tamilnad. On 22—8—1956 Tamilnad had fairly widespread rains and the West Coast had only localised showers.

For two days from 23—8—1956 the weather was mainly dry in the West Coast while Tamilnad had some localised showers. On 25—8—1956 the weather became dry throughout the State. Localised thunder-showers were received in the State on 26—8—1956. Malabar and South Kanara had dry weather for three days from 27—8—1956 while showers were localised in the rest of the State. On 30—8—1956 rains were fairly widespread in Travancore-Cochin and localised in Tamilnad. On the last day of the month rains were fairly widespread in the West Coast and localised in Tamilnad.

Considering the month as a whole, rains in August, 1956 were sub-normal in the West Coast and Hills and also in the districts of North Arcot, Tanjore, Salem, Tiruchirapalli and Ramanathapuram. In other districts they were fairly above normal.

The noteworthy rainfall and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rainfall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
8/8/56	Fort Cochin	3·0	North	6·5	+ 1·6	Above normal
16/8/56	Mercara	4·0	East Coast	5·2	+ 0·6	do
16/8/56	Palghat	4·0	Central	2·4	— 0·9	Below normal
22/8/56	Nagapattinam	3·0	South	2·1	+ 0·5	Above normal
30/8/56	Madras (Meenambakkam)	3·0	West Coast	13·8	— 6·0	Below normal
			Hills	3·9	— 1·8	do

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 10—9—1956

C. B. M. & M. V. J.

Departmental Notifications

Upper Subordinates — Postings and Transfers

Name and present post	Posted as
Muthukrishnan, C. R., Foreign Service,	Fruit Assistant, Coimbatore
Sundaram, N., Oddarpalayam,	Oil Seeds Assistant, Tindivanam
Srinivasan, T. R., on deputation	Chemistry Assistant, Coimbatore
Satyamurthy, C. S.,	Assistant in Mycology, Coimbatore
Thulasi Das, G., Cane Assistant, Palur,	Assistant in Botany, Coimbatore
Venkataramanan, C. R., on deputation	Chemistry Assistant, Coimbatore

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO A FACTUAL RECORD OF SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the month of July, 1956

Cotton: (In this Section: Candy = 784 lb. Pothies = 280 lb.)

Cotton Stocks: Tirupur: Lint: The Cotton Market in Tirupur started with an opening stock of 7,067 candies of Cambodia and 1,492 candies of Karunganni lint. Arrivals during the month amounted to 6,219 candies of Cambodia and 671 candies of Karunganni lint produced from ginneries. Despatches from Tirupur accounted for 5,430 candies of Cambodia and 447 candies of Karunganni which include 1,407 candies of lint sent to Travancore-Cochin State, Ahmedabad, Bombay, Calcutta and Madurai. The month closed with a stock of 7,847 candies of Cambodia and 1,716 candies of Karunganni lint.

Kapas: The kapas market in Tirupur started with an opening balance of 22,325 pothies of cambodia 1,331 pothies of Karunganni. Arrivals during the month amounted to 12,800 pothies and 1,128 pothies of Karunganni kapas. These arrivals include 3,124 pothies of kapas received from Salem, Madurai and Tanjore. 18,611 pothies of Cambodia and 1,838 pothies of Karunganni kapas were disposed after leaving a balance of 16,154 pothies of Cambodia and 621 pothies of Karunganni kapas.

Koilpatti: Lint: The cotton market opened with a stock of 98 candies of Karunganni lint, 500 candies were received from the surrounding areas. Disposals amounted to 450 candies and leaving closing balance of 148 candies towards the close of the month.

Kapas: The kapas market started with an opening stock of 1,100 pothies of kapas. Arrivals amounted to 2,500 pothies from the surrounding villages out of which 3,000 pothies were disposed after

leaving a closing stock of 600 pothies at the end of the month. Arrivals of Uganda cotton were in full swing during the month and about 5,000 pothies were received at Sankarankoil market. Merchants from Bombay and dealers from Rajapalayam and Virudhunagar are reported to be the main buyers in the market. The market closed with a stock of 1,500 pothies.

Ramanathapuram : Lint : The Karunganni lint market in all the markets continued to be dull during the month but firm. The stock at the beginning of the month in the chief markets of Virudhunagar and Sathur markets of this district was 1,245 candies, 2,370 candies were received. 2,430 candies were disposed of after leaving a balance of 1,165 candies at the end of the month.

Kapas: The markets for Karunganni at Virudhunagar and Sathur continued to be dull and steady throughout the month with moderate arrivals and limited transactions. It is observed that nearly 5,000 pothies at Virudhunagar and 2,000 pothies at Sathur still remain unsold with the producers who are reported to be hoarding up the stock in the hope of getting better prices. The arrivals of Uganda kapas were fair and it is estimated by the trade that the production will be in the region of 15,000 to 20,000 bales during this year in Ramanathapuram district. The three markets started with an opening stock of 2,300 pothies, 16,200 pothies were arrived into the market, 16,800 pothies were disposed of after leaving a closing balance of 1,700 pothies at the end of the month.

South Arcot District: Kapas: About 32 pothies of cotton kapas were received at Villupuram market. There were no despatches at all during the month. The stock with the trade at the end of the month stood at 63 pothies.

Cotton Prices; Tirupur: Lint: The prices of Cambodia lint showed a slight decline while the Karunganni lint exhibited an upward trend due to parity of stock.

Kapas: The prices of Cambodia kapas exhibited a receding trend while the kapas of Karunganni tended to be on the gaining trend.

Koilpatti: Lint: The prices remained steady at Rs. 800 to 820 till last week of the month due to the resistance offered by the mills. The prices sputed to Rs. 830 to 860 during the last week, when the mills revived their purchases. The market closed firm since the stock left with the producers and trade is estimated only at about, 1,500 candies. Uganda lint continued to be more or less steady round about Rs. 980 to 1,000 for the uncertified quality.

Kapas: The karunganni kapas remained more or less steady fluctuating between Rs. 100 to 105 per pothi. The prices of Uganda kapas

opened at 115 to 125 per pothi continued to be steady. The prices slightly increased in last week and ruled at 120 to 130 per pothi.

Cotton Seeds: The prices of Karunganni cotton seeds continued to be firm at Rs. 37 to 39 per pothi.

Ramanathapuram: Lint: The prices of lint in all the three markets of this district continued to remain steady except in Karunganni lint where the prices revealed an increase. The opening and closing prices of different varieties of cotton lint per candy are given below:

		Opening Rates	*Closing Rates*
		Rate per candy	
Karunganni	...	Rs. 830 to 850	Rs. 868 to 945
Tinny Karunganni	...	Rs. 820 to 830	Rs. 815 to 830
Tinny	...	Rs. 786 to 815	Rs. 786 to 815
Uganda Rajapalayam	...	Rs. 970 to 990	Rs. 971 to 991

Kapas: More or less steady price conditions prevailed during the month within marginal limits of fluctuations. The opening and closing prices of kapas during the month were as follows:

		Rate per pothi	
		Opening rates	*Closing rates*
Karunganni	...	Rs. 103 to 110	Rs. 106 to 110
Tinny Karunganni	...	Rs. 94 to 101	Rs. 93 to 103
Tinny	...	Rs. 71 to 93	Rs. 88 to 92
Uganda Rajapalayam	...	Rs. 104 to 118	Rs. 108 to 122

Cotton seeds: The prices of cotton seeds for different varieties were as follows during the month.

	Opening rates	*Closing rates*
	Price per Std. Md.	
Karunganni	12/5 to 12/8	11/8 to 12/4
Uganda	10/- to 10/10	9/- to 9/4

South Arcot: Kapas: The prices of cotton kapas in South Arcot district ranged between Rs. 88-14-0 to 91-6-0 per pothi.

II. **Groundnut:** (In this section: Tons = 2240 lbs.
Candy = 531 lbs.
Bag = 80 lbs.)

South Arcot district: Stocks: Arrivals of Groundnuts in all the markets of the district were fair on account of accelerated harvest of

summer crop. The transactions of Groundnut that took place during this month in the district were as indicated below:

Opening balance at the beginning of the month	...	3,471 tons.
Arrivals into all the markets	...	6,380 ,,
Receipts from North Arcot, Salem, Tanjore and Tiruchirapalli, districts	...	618 ,,
Despatches to districts like Salem, Tanjore Madras etc.	...	2,212 ,,
Exports to other States	...	191 ,,
Consumption by local mills	...	2,787 ,,
Consumption by *chekkus*	...	244 ,,
Appropriate wastage	...	175 ,,
Closing stock at the end	...	3,471 ,,

Prices: The average prices of Groundnut kernels in the several markets ruled around Rs. 174 per candy in the first week and after a gradual increase in arrivals the prices declined to Rs. 165 in the last week of the month.

North Arcot district: Stocks: Arrivals were very poor due to negligible stock with the producers and traders. Off-take also went down and merchants were not keen in crushing as all of them are waiting the concession granted in the payment of oil cess. The markets opened with 1,487 tons of pods and 890 tons of kernels. Receipts during the month accounted for 89 tons of pods and 241 tons of kernels, while 417 tons of pods and 535 tons of kernels were disposed. The market closed wih a balance of 1,159 tons of pods and 596 tons of kernels.

Prices: The prices of Groundnut kernels in North Arcot district have not greatly changed during the month. Prices were quoted around Rs. 160-165 per candy while during the same period of last year it stood around Rs. 115-120 per candy.

Ramanathapuram district: The markets of Ramanathapuram started with an opening stock of 500 tons of kernels alone with which 750 tons of Pods and 4,750 tons of kernels were added. Disposals amounted to 750 tons of pods and 3,950 tons of kernels leaving a closing balance of 1,300 tons of kernels alone.

The opening and closing prices of Groundnut kernels during the month were quoted at Rs. 160-180 and 160-173 respectively.

III. **Gingelly:** (In this section: Bag = 168 lb.)

South Arcot District: Arrivals into the five markets of the district amounted to 452 bags besides 222 bags held as closing balance of last month. Receipts from neighbouring districts totalled 174 bags. 587

bags were utilised for crushing. Despatches to Tanjore district amounted 105 bags after leaving a closing balance of 156 bags.

Prices: Market at Virudhachalam opening at Rs. 78 per bag and gradually improved till the middle of the month. The prices declined from third week and came down to Rs. 56/5 per bag at the end of the month as a result of increased arrivals and availability.

IV. **Coconut and its products:** (In this section: Cdy = 700 lb.)

Coconuts: *Stocks:* The arrivals were low due to rainy seasonal conditions. The transactions of coconuts in Malabar and South Kanara were as follows:

(*In thousands*)

	Opening balance	Arrivals	Disposals	Closing balance
Malabar District:				
Kozhikode ...	7,665	3,832	4,000	7,497
Badagara ...	818	2,600	2,814	604
Ponnani ...	Not Reported (N. R.)			
Tellicherry & Dharmadam ...	612	978	1073	517
South Kanara District:				
Mangalore ...	80	130	135	...

Prices: The prices continued to be low with slight fluctuation in Kozhikode market in Malabar and South Kanara districts. The maximum and minimum prices of coconuts in the markets of Malabar and South Kanara are given below.

Malabar District: (Husked, per 1000.)

	Minimum	*Maximum*
Kozhikode ...	Rs. 108	Rs. 98
Badagara ...	„ 90	„ 85
Tellicherry & Dharmadam ...	„ 105	„ 100

South Kanara District: (per 1000 nuts.)

	Maximum	*Minimum*
Mangalore, Raw	Rs. 140	Rs. 115
do. Dry	Rs. 180	Rs. 135

Copra: The market arrivals were restricted due to monsoon weather. There was a good demand from Bombay and local millers.

The stock particulars of copra in Malabar and South Kanara districts are extracted below:

Market	Opening balance	Receipts	Disposals	Closing balance
Malabar district: (In cdys.)				
Kozhikode ...	5,263	2,650	2,990	4,923
Badagara ...	650	2,000	11,845	805
South Kanara District:				
Mangalore (In tons)...	85	422	390	117

Prices: The prices advanced mildly due to good demand. The prices of different varieties of copra in the markets of Malabar district are extracted below.

(*Prices per candy*)

Variety	*Kozhikode* Minimum	*Kozhikode* Maximum	*Badagara* Minimum	*Badagara* Maximum
Office ...	Rs. 295	Rs. 290	Rs. 290	Rs. 280
Edible ...	,, 310	,, 300	,, 305	,, 300
Madras ...	,, 300	,, 300	,, 300	,, 300
Rajpur ...	,, 325	,, 320	,, 320	,, 320

The prices in Mangalore market ranged between Rs. 275 to 300 per candy.

V. **Arecanuts:** (In this section Bag = 100 lbs)

Stocks: Curing is in full swing in all important centres. Transactions in Raw arecanut continued to be brisk in the Regulated market at Thalakadathur. The stock particulars of arecanut in the markets of Malabar and South Kanara district are given below:

District.	*Opening balance.*	*Receipts*	*Disposals*	*Closing Stock.*
Malabar District: (In Bag 100 lb.)				
Kozhikode ...	163	1,512	1,385	290
South Kanara District:				
Mangalore (in cwts.) ...	10,312	3,400	5,400	8,312

bags were utilised for crushing. Despatches to Tanjore district amounted 105 bags after leaving a closing balance of 156 bags.

Prices: Market at Virudhachalam opening at Rs. 78 per bag and gradually improved till the middle of the month. The prices declined from third week and came down to Rs. 56/5 per bag at the end of the month as a result of increased arrivals and availability.

IV. **Coconut and its products:** (In this section: Cdy = 700 lb.)

Coconuts: *Stocks:* The arrivals were low due to rainy seasonal conditions. The transactions of coconuts in Malabar and South Kanara were as follows:

(*In thousands*)

	Opening balance	Arrivals	Disposals	Closing balance
Malabar District:				
Kozhikode ...	7,665	3,832	4,000	7,497
Badagara ...	818	2,600	2,814	604
Ponnani ...	Not Reported (N. R.)			
Tellicherry & Dharmadam ...	612	978	1073	517
South Kanara District:				
Mangalore ...	80	130	135	...

Prices: The prices continued to be low with slight fluctuation in Kozhikode market in Malabar and South Kanara districts. The maximum and minimum prices of coconuts in the markets of Malabar and South Kanara are given below.

Malabar District: (Husked, per 1000.)

	Minimum	*Maximum*
Kozhikode ...	Rs. 108	Rs. 98
Badagara ...	„ 90	„ 85
Tellicherry & Dharmadam ...	„ 105	„ 100

South Kanara District: (per 1000 nuts.)

	Maximum	*Minimum*
Mangalore, Raw	Rs. 140	Rs. 115
do. Dry	Rs. 180	Rs. 135

Copra: The market arrivals were restricted due to monsoon weather. There was a good demand from Bombay and local millers.

The stock particulars of copra in Malabar and South Kanara districts are extracted below:

Market		Opening balance	Receipts	Disposals	Closing balance
Malabar district: (In cdys.)					
Kozhikode	...	5,263	2,650	2,990	4,923
Badagara	...	650	2,000	11,845	805
South Kanara District:					
Mangalore (In tons)	...	85	422	390	117

Prices: The prices advanced mildly due to good demand. The prices of different varieties of copra in the markets of Malabar district are extracted below.

(*Prices per candy*)

		Kozhikode		*Badagara*	
Variety		Minimum	Maximum	Minimum	Maximum
Office	...	Rs. 295	Rs. 290	Rs. 290	Rs. 280
Edible	...	„ 310	„ 300	„ 305	„ 300
Madras	...	„ 300	„ 300	„ 300	„ 300
Rajpur	...	„ 325	„ 320	„ 320	„ 320

The prices in Mangalore market ranged between Rs. 275 to 300 per candy.

V. **Arecanuts:** (In this section Bag = 100 lbs)

Stocks: Curing is in full swing in all important centres. Transactions in Raw arecanut continued to be brisk in the Regulated market at Thalakadathur. The stock particulars of arecanut in the markets of Malabar and South Kanara district are given below:

District.		*Opening balance.*	*Receipts*	*Disposals*	*Closing Stock.*
Malabar District: (In Bag 100 lb.)					
Kozhikode	...	163	1,512	1,385	290
South Kanara District:					
Mangalore (in cwts.)	...	10,312	3,400	5,400	8,312

Prices: The prices at Mangalore and Kozhikode market were more or less steady and are furnished below:

Mangalore: (per cwt.)		*Minimum*	*Maximum*
Koka	...	Rs. 125	Rs. 80
Choll	...	„ 169	„ 155
Malabar Supari	...	No stock.	
Mangalore „	...	„ 172	„ 145
Malabar: ($115\frac{1}{2}$ lbs.)			
Kozhikode	...	„ 76/8	„ 56/12

VI. **Tobacco:** (In this section candy = 500 lbs.)

Tirupur: Stocks: The tobacco market started with an opening of 24,330 candies of chewing tobacco and 2,500 candies of cheroot varieties. About 50 candies of chewing tobacco from Madurai and 100 candy of bidi tobacco from Bombay, Gujarath were imported. Despatches during the month amounted to 3,870 candies of chewing 600 candies of cheroot varieties made to place like Palghat, Pudukottai, Karaikudi, Aleppy, Tiruchirapalli, Kottar, Dindigul, Madurai, Chingleput, North Arcot and South Arcot.

Prices: The prices of different varieties of tobacco in Tirupur market during the month were as extracted below.

(Prices in Rs. per cdy of 500 lb.)

Variety		*I grade*	*II grade*	*III grade*
1. *Chewing Tobacco, (Sun-cured):*				
a. Meenampalayam	...	350 — 420	230 — 320	150 — 200
b. Other varieties	...	260 — 305	175 — 220	90 — 120
2. *Cheroot varieties.*				
Sun-cured (grown in Erode and Bhavani Taluks.)	...	280 — 340	220 — 270	110 — 155
3. *Chewing varieties:*				
Pit-cured (grown in Palladam and Sulur areas.)	...	250 — 350	175 — 250	100 — 150

Review of the Administrative Activities of the Market Committees during July 1956

All the Market Committees continued to function during the month under Section 6A of the Madras Commercial Crops Markets Act under the respective district revenue authorities except the Coimbatore Market Committee which is functioning under an elected body. Conduct of fresh elections in the other Market Committees is also being done. The stalemate in the Tirunelveli Market Committee and the Ramanathapuram Market Committee is yet to be cleared awaiting the judgment of the Supreme Court.

The following progress was made by the Market Committees in the issue of licenses under the provisions of the Madras Commercial Crops Markets Act.

	Section 5 (1)		Section 5 (3)		Weighmen		Broker	
	A	B	A	B	A	B	A	B
North Arcot Market Committee	143	882	48	578	18	350	1	7
South Arcot Market Committee	218	1393	180	1208	159	1113	1	9
Coimbatore Market Committee	87	735	76	768	49	543	—	12
Ramanathapuram Market Committee	9	29	8	28	5	5	—	—
Tirunelveli Market Committee	3	13	4	16	5	7	—	—
Malabar Market Committee	33	314	107	1328	55	280	—	5
South Kanara Market Committee	38	136	4	62	—	56	—	—

A : During the month. B : Upto the end of the month from January.

Meetings: A meeting of the Coimbatore Market Committee was held during the month when nine subjects were discussed. Some of the resolutions passed at the meeting are extracted below:

1. The lease period of Erode yard was extended for a further period of one year from 21—8—56.

2. The Secretary was authorised to take legal action against groundnut Merchants and Groundnut Oil Mill Owners who have not paid the cess due to the Committee as per the amended act.

3. It was resolved to invest the sum of Rs. 17,100 being the amount of unexpended balance of 1955 in South Indian Bank, Ltd., Tirupur for a period of one year instead of in the Co-operative Bank Coimbatore.

Quality appraisal: The South Arcot Market Committee continued its work on the analysis of groundnut kernels marketed in

that district. During the month 172 samples were drawn and analysed in five markets from out of arrivals of 39,903 bags of groundnut kernels in 3,125 lots. The total common refraction was below 4% in 171 samples — 5 to 8% in one sample. Damages were below 2% in 126 samples while it was above 2% and within 4% in 21 samples and above 4% in 25 samples. The details of such analysis are extracted below:

Particulars	Cuddalore	Villupuram	Tirukoilur	Virudhachalam	Panruti
1. *Dryage:*					
2% and below ..	—	1	3	44	1
above 2% and upto 3% ..	3	—	2	8	—
above 3% and upto 4% ..	1	1	4	3	2
above 4% and upto 5% ..	2	4	4	3	1
above 5% and upto 10% ..	10	11	10	—	10
above 10% ..	1	—	—	—	24
2. *Total common refraction:*					
4% and below ..	13	1	11	51	33
above 4% and upto 8% ..	14	—	11	7	5
above 8% ..	2	18	1	—	—

Quality competition: The particulars of entries secured by the South Arcot Market Committee for summer crop quality competition which commenced on 1—6—56 are furnished below:

During the month	86
Upto the month from 1—6—1956	106

Crop and Trade Reports

Varagu — Madras State — 1955 - '56 — Third or Final Forecast: The area sown with varagu (Paspalum Scrobiculatum) in the Madras State in 1955 - '56 is estimated at 837,800 acres. Compared with the provisional area of 849,000 acres in the previous year according to the Season and Crop Report, the current year's estimate is a decrease by 1·3 per cent. Compared with the average area of 735,400 acres calculated for the five years ended 1954 - '55, the present estimate is an increase of 13·9 per cent. The crop is grown on a negligible extent in the Nilgiris district and is not grown in South Kanara district. Compared with the previous year, an increase in area is estimated in the current year in the districts of South Arcot, North Arcot, Salem, Coimbatore and Tanjore and a decrease in area in the other districts, except Malabar where the area estimated is the same as that of last year.

The bulk of the crop has been harvested. The yield per acre of kharif crop is estimated to be normal in Chingleput and South Arcot districts and below normal in the other districts of the State. The yield per acre of rabi crop is estimated to be below normal in all the districts of the State. The condition factors for the State as a whole work out to 93 percent of normal for the Kharif crop and 95 percent for the Rabi crop as against 98 percent and 94 percent respectively in the previous year. The total yield of both Kharif and Rabi crops works out to 338,100 tons of unhusked grain or 202,900 tons of cleaned grain. Compared with the provisional estimate of 354,900 tons of unhusked grain or 212, 900 tons of cleaned grain according to the Season and Crop Report for the previous year, the current year's estimate shows a decrease of 4.7 percent, The present estimate shows an increase of 20.4 percent as compared with the average production of 280,900 tons of unhusked grain or 168,500 tons of cleaned grain calculated for the five years ended 1954—'55.

Cotton - 1955—'56 - Fifth and Final Forest Report - Madras State: The area under cotton in year for 1955—'56 for the Madras State is estimated at 978, 500 acres. Compared with the estimated area of 871,700 acres for the previous year and an average area of 816,800 acres calculated for the five years ending with 1954—'55, this is an increase of 12.3 per cent respectively. An increase in area is estimated in all the districts of the State except in Chingleput, South Kanara and the Nilgiris. A decrease in area is estimated in the district of Chingleput. The area estimated is the same as that of last year in South Kanara district and the area in the Nilgiris district is little or negligible.

Picking of cotton is in progress. The crop was affected by inadequate rains in Salem district. The crop was affected by cyclone in Ramanathapuram district. Withering of crop was reported from parts of Salem district. The crop was affected by pest in parts of Coimbatore and Tirunelveli district. The condition of the crop in other districts was generally satisfactory. The seasonal factor for the State as a whole works out to 86 per sent of the normal as against 92 per cent for the previous year. On this basis the total yield works out to 300,000 bales of 392 lbs. lint as against 270,500 bales of 392 lbs. lint for the previous year and an average yield of 254,900 bales for the five years ending with 1954—'55, representing an increase of 10.9 per cent and 17.7 per cent respectively. It is however too early to estimate the yield with accuracy as much will depend upon the future weather conditions and their effect on the crop.

The estimated area and yield of cotton by varieties in the current year together with the corresponding figures for the previous year are given below :

Variety		Area in "00" Acres		Yield in "00" bales of 392 lbs. lint	
		1955—'56	1954—'55	1955—'56	1954—'55
Madras American Cambodia	Irrigated	1,780	1,101	1,153	729
	Unirrigated	1,582	1,047	385	279
Madras American Cambodia (Uganda)	Irrigated	336	477	190	310
	Unirrigated	465	758	106	188
Total Cambodia		4,163	3,383	1,834	1,515
Uppum (including Nadam and Bourban)		708	646	106	104
Karunganni		4,069	3,613	859	821
Karunganni (Ordinary)		845	1,075	201	255
Total		4,914	4,688	1,060	1,085
Grand Total		9,785	8,717	3,000	2,705

Korra - Madras State - 1955—'56 - Third or Final Forecast: The area sown with korra or tenai (Setaria Italica) in the Madras State in 1955—'56 is estimated at 85,100 acres. Compared with the provisional area of 82,100 acres in the previous year according to the season and crop report, the current year's estimate shows an increase of 3.7 percent. Compared with the average area of 90,400 acres calculated for the five years ended 1954—'55, the present estimate is a decrease by 5.9 percent. The crop is not grown in South Kanara district. The area estimated is the same as that for the previous year in the districts of North Arcot, Tanjore, Tirunelveli and the Nilgiris. An increase in area is estimated in the districts of South Arcot, Coimbatore, Madurai, Ramanathapuram and Malabar and a decrease in area in the other districts viz., Chingleput, Salem and Tiruchirapalli.

The bulk of the crop has been harvested. The yield per acre of kharif crop is estimated to be normal in South Arcot and Tirunelveli districts, and below normal in the other districts of the State. The yield per acre of rabi crop is estimated to be below normal in all the districts of the State. The condition factor for both kharif and rabi crops for the State as a whole works out to 95 per cent of the normal, as against 96 per cent for the kariff crop and 93 per cent for the rabi crop in the previous year. The total yield of both kharif and rabi crops works out to 26,300 tons of unhusked grain or 21,000 tons of cleaned grain. Compared with the provisional estimate of 25,400 tons of unhusked grain or 20,300 tons of cleaned grain according to the season and crop report for the previous year, the current years estimate shows an increase of 3·5 per cent. The present estimate is an increase of 8·7 per cent as compared with the average

production of 24,200 tons of unhusked grain or 19,400 tons of cleaned grain calculated for the five years ended 1954–'55.

Sugarcane — Fourth and Final Forecast Report — 1955 - '56 Madras State: The area under sugarcane in Madras State during 1955 - '56 is estimated at 1,30,900 acres (1,14,790 acres under planted crop and 16,110 acres under ratoon crop). Compared with the finally recorded area of 1,34,630 acres (1,19,700 acres under planted crop and 14,870 acres under ratoon crop) for the previous year, this is a decrease of 2 8 per cent. Compared with the average area of 1,08,200 acres calculated for the previous five years ending 1954 - '55, the present estimate is an increase of 21·0 per cent. A decrease in area is estimated in the districts of South Arcot, Salem, Coimbatore, Madurai, Ramanathapuram, Tirunelveli and Malabar and an increase in the other districts of the State except Chingleput and the Nilgiris. The acreage under the crop in Chingleput district is the same as that of last year and the area in the Nilgiris district is little or negligible. The seasonal factor for the State as a whole works out to 94 per cent of the normal as against 96 per cent of the normal estimated for the previous year. On this basis, the total yield works out to 33,18,590 tons of cane, the gur equivalent of which is 3,61,960 as against 3,512,150 tons of cane with a gur equivalent of 3,83,880 tons estimated for the previous year representing an decrease of 5·7 per cent. Compared with a average yield of 26,46,120 tons of cane with a gur equivalent of 2,90,259 tons calculated for the previous five years ending with 1954 - '55, the present estimate shows an increase of 24 7 per cent.

Tobacco—Third and Final Forecast Report —1955 - '56 — Madras State: The area sown with tobacco in the Madras State in 1955 - '56 is estimated at 45,400 acres. Compared with the actual area of 43,300 acres for the previous year and the average area of 44,500 acres calculated for the previous five years ending with 1954–'55,'55 the present estimate shows an increase of 4 8 per cent respectively. An increase in area is estimated in all the districts of the State in Chingleput, North Arcot, Salem, Tanjore, Madurai Tirunelveli and the Nilgiri districts. In North Arcot, Salem, Tanjore and Tirunelveli districts the area under the crop is the same as in last year.

The crop has been harvested or is being harvested in parts of the State. The seasonal factor for the State as a whole works out to 92 per cent of the normal for Nicotiana Rustica, 91 per cent of the normal for Virginia variety of Nicotiana Tobacum and 90 per cent of the normal for all other types of Nicotiana Tobacum as against 94, 93 and 91 per cent of the normals respectively estimated for the previous year. On this basis the total yield works out to 24,300 tons of cured leaf as against 23,000 tons of cured leaf estimated for the previous year representing an increase of 5·7 per cent. Compared within the average yield of 20,200 tons calculated for the five years ending with 1954 - '55, the present estimate is an increase of 20 3 per cent.

Samai crop — Third and Final Report — 1955 - '56 — Madras State: The area sown with Samai (Panicum Miliare) in the Madras State in 1955 - '56 is estimated at 5,38,800 acres under the crop in the previous year, the current year's estimate is a decreased of 3·4 percent. It however, shows an increase of 6·5 per cent over the average area of 5,05,700 acres estimated for the five years ended 1954 - '55. The area estimated is the same as that of the previous year in the districts of Tanjore and South Kanara. An increase in area is estimated in the districts of Coimbatore, Tirunelveli and the Nilgiris and a decrease in the other districts of the State.

The crop has been or is being harvested in most districts. The yield per acre in respect of the kharif crop is estimated to be normal in the districts of South Arcot, Malabar, South Kanara and the Nilgiris and that of the Rabi crop in the Nilgiris district. In the other districts, the yield per acre is expected to be below normal. The seasonal factor for the kharif crop for the State as a whole works out to 95 per cent of the normal and that of the Rabi crop to 92 per cent as against 96 per cent for the kharif crop and 98 per cent for the Rabi crop in the previous year. On this basis, the total yield works out to 99,000 tons of unhusked grain or 54,500 tons in terms of cleaned grain. This shows a decrease of 4.6 per cent when compared with 103,800 tons of unhusked grain or 57,100 tons in terms of cleaned grains estimated for the previous year and an increase of 19 9 per cent over the average production of 82,600 tons of unhusked grain or 4,400 ton in respect of cleaned grain for the five years ended 1954—'55.

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Editorial

National prosperity in our country is largely the prosperity of the farming community, who constitute nearly eighty per cent of our population. Even amidst all the industrial development around us, agriculture is still the most important vocation in the national economy and would continue to be so for quite a long time to come. It is accepted on all sides that agriculture is the foundation of national wealth and that farm income and national income rise and fall together. The income of the farmer is based on three things, the output per acre, the cost of production and the prevailing prices for agricultural produce. The output and cost of production are inter-related, but in any final analysis, the ultimate factor deciding income is the price.

In recent months agricultural prices are spiralling up and Government are adopting various measures to bring them down. It is essential that the basic products of agriculture, namely food and raw materials of industry should be available at reasonable prices and all measures adopted to achieve this end will have universal approval. What is equally important, however, is that these measures should not adversely affect the income of the farmer or his standard of living. It is notorious that this standard of living in the agricultural sector is already of a very low order and any deterioration will only result in dire poverty. The peculiar situation in agriculture is that it is not organised as the other sectors and in the event of any downward phase in the price cycle, the farmer has still to carry on, for a ruinous return.

In his own economy, the farm costs are mounting up with increases in labour wages and other prime costs. Amidst these rising costs, the small producers who form the

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In his own economy, the farm costs are mounting up with increases in labour wages and other prime costs. Amidst these rising costs, the small producers who form the

majority are still lacking in resources to adopt improved technological production methods with the result that their yields continue to be low, cutting in on any surplus they may have. Even with better credit facilities and good surpluses, liquidation of accumulated debts would prove difficult unless price levels are favourable. Thus farmers would ever remain indebted. Any policy leading to this situation in the agricultural sector may defeat the very objective of our plans to improve the standard of living of our masses with higher employment and better income.

The fixation and stabilisation of agricultural prices at an economic level therefore, calls for an examination of the costs and economy of agricultural production. In spite of their wide variation, reasonable figures could be arrived at to guide price stabilisation policies. Agriculture in our country is often said to be a gamble with the monsoons and prices. In a planned economy it need not be.

Livestock Industries in Australia

by

C. L. SUNDARARAJAN, B. sc. (Ag.)

Sheep: Australia is the leading wool producing country in the world. With less than one-sixth of the world's sheep population, she produces more than one quarter of the world's wool. It is often said that Australia is riding on the sheeps' back and that the nation is built on grass. Export figures (£ 42 millions or 50% of the total exports) vouchsafe for the accuracy of the former statement. How literally true the latter statement is, one can only understand from a visit to many of the sheep stations scattered right through the continent. Whether in the rich Camperdown district in Victoria or in the poorer Urriara and Tharwa of New South Wales, one cannot but be struck by the wonders that the clovers are doing for the farmer in particular and the nation in general. Apart from its intrinsic value as a good feed, the clover plants are so many miniature fertiliser factories fixing atmospheric Nitrogen in the soil and adding fertility to the paddock in the same way as and at a lesser cost than, the factories. By a series of trials and experiments over a period of many many decades, various strains of clovers have been selected and adapted for the development of the pastoral industry. And in recent years a new strain of sub-clover which thrives in sub-tropical conditions, has been evolved by workers in Sydney University. Attempts are still being made to find suitable legumes for growth in the tropical areas. The significant work done by scientists in discovering nutritional deficiencies of each individual type of soil and rectifying them by the application of super-phosphate and many trace elements specially molybdenum, copper, zinc or cobalt, has transformed many of the former scrub lands into good pastoral areas. Nor less important is the pioneering work done by the early settlers in introducing Merino and other breeds of sheep and evolving suitable strains to suit different local conditions; strains different in their body size, appearance, response to varying climatic conditions and feed requirements, but all producing the best of a number of types of wool to meet the varied requirements of the modern markets.

Scarcity of water and arid conditions are the bone of the country; but the innumerable tiny patches of water so meticulously conserved from run-off during times of high rainfall, by the construction of small earthern dams, and a good number of shallow

bore wells worked by wind mills, so characteristic of the Australian rural scenery, open our eyes to the wonders one can do in the most adverse situations. Each farm is subdivided into a number of paddocks enclosed by the same monotonous barbed wire fencing, 4 feet high with closely knitted fencing for the first three feet, which we learnt, is essential for rotational grazing and for keeping off that plague of pastoral industry — the rabbit, five of which consume as much grass as one sheep does. Here too, modern seience has come to the rescue of the farmer in the form of myxomatosis — the deadly virus which has helped the almost complete extermination of the pest. Once on a sheep farm, we are at first perplexed by the innumerable "cocky gates", stocks of various medicines and appliances in the farm, the very many dipping and spraying devices, the different types of machinery, the various dwelling houses for shearers and farm hands and lastly the inevitable sheep dogs. No wonder then that the Australian sheep industry is a specialised one and it is by no mean chance that the Australian sheep gives the highest yield of the best clips of the world.

Coming to the details of production, we find that, with the use of superphosphate and of minor trace elements for fertilizing the paddocks, the subclover *(Trifolium subterraneum)* thrives well and in due course stores up nitrogen in the soil thus increasing its fertility. The various grasses like rye grass, Paspalum, *(Paspalum dilatatum)* or Cocksfoot, depending upon the rainfall of the area put on growth in proportion to the nitrogen status of the soil. This results in a good pasture of legume cum grass, which combination caters to the protein and carbohydrate requirements of the animals grazing on it. As compared to the native pastures, the improved pasture not only gives increased yield of fodder, but gives a fodder of superior nutritive value. The subclover seeds profusely and the seeds serve as excellent food concentrate during dry summer when all the plants dry out. Experiments carried out at Dickson Experiment Station, Cnaberra indicated that the introduction of subclover alone in the native pastures increased the carrying capacity of the paddock to two sheep per acre, while the introduction of a suitable grass, rye grass, and use of super - phosphate increased the carrying capacity to six sheep per acre as opposed to one sheep per acre usually carried by the native pasture. In another set of experiments it was proved that the average weight of sheep on improved pasture was 99 lb. compared to that of 52 lb. of a sheep on un - improved pasture. The yield of wool per sheep rose

from 9 lb. to 12 lb. The lambing of ewes increased from 65% to 110%, while the wool from improved pasture was claimed to be of a better staple and of finer quality. The irrigated pastures carried 8 to 10 sheep per acre per annum.

The subclover seeds profusely right under the ground and regenerates itself during autumn every year. A pasture of subclover and rye grass is thus kept on indefinitely for years till the soil becomes too rich for clover and is, therefore, dominated by grasses. The high latent fertility of the soil is then cashed in by raising a cereal crop, wheat, barley or oats or rice, reference to which is made later. We came across at least two outstanding farmers in two places, far apart who claimed an average clip of 14 lb. of wool per sheep per annum. Both were prosperous farmers owning, even by Australian standards, large blocks of land under improved pasture and managing their property in the most efficient manner.

The locality of a farm determines the breed of sheep and the type of sheep farming carried out on that farm. In well-watered country with even rainfall and good growth of pasture, fatlamb production assumes importance and the production of wool becomes subsidiary. Fatlamb production and cross breeding of sheep (Merino and any one of the British breed of sheep — Lincoln, Border Leicester or Romney Marsh or Dorset Horns) go together. The aim of cross breeding is the production of a dual purpose animal, the ewes of which have a body form with good mutton qualities and yield a reasonable amount of tolerably good quality wool. The wool pays the upkeep of the ewe for the year leaving the fat lamb as the profit. The lamb attains a live weight of 75 lb. in about 16 weeks time. It has been estimated that in a flock of 100 ewes with 80% lambing, a gross return of £ 586 is attained, £ 246 being the value of fleece and £ 340 being the value of lambs. The gross return per ewe per annum is £ 5—17—0. In another survey the net return per sheep per annum is estimated at £ 2—4—0.

Merino sheep are kept in comparatively arid country with light rainfall and extremes of temperature. Food is scarce and the merino with its hardy body is able to traverse long distances for food and water. There are a number of strains of merino for different types of country. Corriedales and Polwarths, evolved in Australia and New Zealand, are also to be seen in this country. The finest wool comes from the poorest country. Cross-bred sheep give wool spinning up to 56's to 58's while the merino gives wool spinning from 60's to 90's.

The four big jobs in a wool growers' year are dipping, crutching, lamb marking and shearing. Dipping, or more appropriately, spraying the sheep against infestations by external parasites, is done 4 to 6 weeks after the sheep have been shorn. Crutching is shearing off a long oval portion of wool from the sheep's crutch under the tail to keep the area clean and guard against blow fly pest, the maggots of which will kill sheep if infestation is not corrected. This is done a month before the sheep are due for lambing. Each sheep owner has a registered mark and the sheep are marked every year to identify its owner.

Shearing of wool is usually an annual affair taking place at the beginning of summer. Shearing is done with the aid of mechanical contrivances and is an art specialised by a team of people who migrate from station to station and do this tricky job on a contract basis. A good shearer usually shears about 150 sheep per day and gets a wage of £ 7—6—0 per 100 sheep shorn. Flocks of sheep of the same age and sex are shorn separately. Wool-classing is a specialised work and many of the farmers undergo training in wool-classing in the local technical schools. In the bigger sheep stations grading and preparing the clip for the market is done by prefessional classers. Marketing of wool in Australia is entirely a free trade and sales are conducted by open auctions by the great wool brokers in important cities and attended by buyers from all the world over.

Sheep raising is carried on in all parts of the Commonwealth with the greatest concentration of sheep population in New South Wales (60 millions) and Victoria (21 millions) followed by Queensland and South Australia. The total population of sheep in the country is estimated at 127 million heads and the production of wool at 1,245 million pounds. The production of mutton and lamb is estimated at 395,090 tons.

During our visit to one of the warehouses of a firm of wool brokers in Geelong, Victoria, we saw wool being sorted out and rearranged for auctions. One particular bale of superfine wool attracted our attention and we were informed that this bale was from the Victorian Valley, Western Australia, and represented the Super A fine wool in its best. The staple length was 2" and less and the wool would spin 90's. These fine wools were usually exported to Italy for the manufacture of luxurious garments and billiard table cloths. A pound of wool in Grease would fetch

anything from 160 to 200 pence. The price of a pound of average quality of merino wool is at present about 60 pence.

Two serious impediments in the increased use of wollen garments are (1) shrinkage of the material and (2) the difficulty involved in washing and laundering them. These shortcomings place the woolen garments at a decided disadvantage over the new synthetic fibres now flooding the market. To overcome these defects, the wool research Laboratories of the C. S. I. R. O. at Geelong is carrying out some fundamental experiments on these twin problems. Results so far obtained indicate, that shrinkage of the material can be overcome by the use of some synthetic resins during the processing of wool and a slight modification in the processing will make any woolen garment as easily washable as, say cotton or Nylon. Commercial possibilities of these findings are enormous and it looks as though wool will continue to reign supreme in the worlds' fibre market.

Research on the better production of wool and on the many problems associated with the sheep industry are carried out in many of research stations of the C. S. I, R. O., in close colloboration with the departments of Agriculture and the Universities. The Federal Bureau of Agricultural Economics studies subjects dealing with the economics of wool growing and sheep station management. Finance for these research activities is met from a fund to which the common-wealth Government contributes one half of the amount raised under the wool tax.

The Australian Wool Bureau, constituted under the Wool Use Promotion Act 1953, is a body of representatives of wool growers and meat producers charged with taking measures to improve production and increase the use of wool. The activities of the Bureau are financed by a wool tax of 4 sh. per bale of wool produced.

Dairy Industry: A flourishing country is said to be flowing with milk and honey. This statement holds good to a few of the chosen countries of the world and Australia is foremost among them. The number of milk bars one comes across and the enormous consumption of butter, cheese, ice-cream, and other milk products is something colossal. It may even be said that the general health of the population and of the chubby children, we so lovingly fondled in many of the Australian homes we were privileged to stay, is an index of the unfailing supply of that nectar of human health —

milk — and the gigantic proportions of the dairy industry. The industry has been in existance ever since the colony was founded. But the great strides that it made, begin with the perfecting of the technique of cold storage and its application to and use in the ocean-going vessels. Nowadays the Australian dairy products find their way into the homes of many countries in as fresh a state as they left the farms and factories in Australia. In 1953—1954 the net value of all dairy products amounted to £ 135 millions and the dairy industry has to its credit exports valued at £ 30 millions.

In the course of our tours, we visited a good number of typical dairy farms and a few butter factories on the Gippsland Dt., Camperdown Dt., and the irrigated districts of the Murray valley. The dairy industry is concentrated in the richer parts of the country with high rainfall and along the coastal areas east of the Great Dividing Range. The State of Victoria tops the list with a production valued at £ 53 millions followed by New South Wales valued at £ 41 millions.

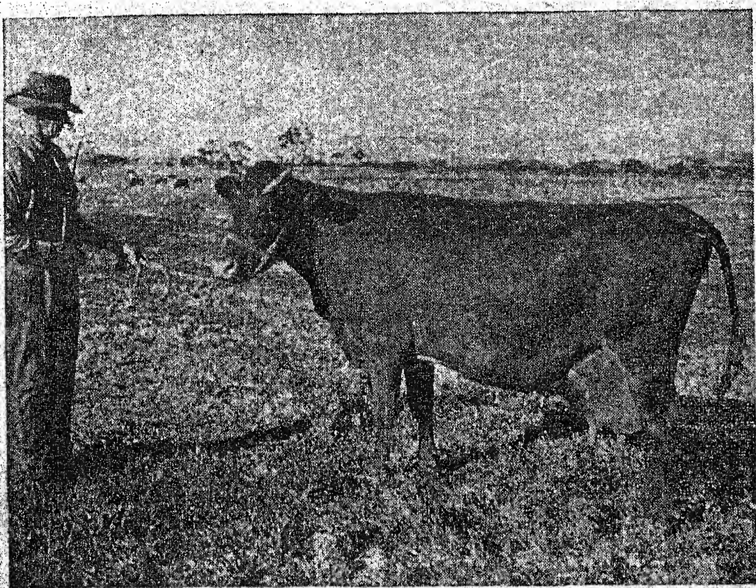
The one peculiar feature that arrested our attention is the complete absence of stall feeding of animals and all the evils associated with it. There are no cow sheds or barns as understood in other parts of the world. No large amount is spent on the purchase of the so-called concentrates considered so essential for maintaining the yield or even of the health of the cow. Here the whole show is so planned, arranged and so highly mechanised to the minute detail that a herd of 50 cows in milk the minimum maintained by a commercial dairy farmer to maintain a decent standard of living (£ 1500 to £ 2000 net income per annum) is entirely and efficiently managed by the farmer with the assistance, perhaps, of his wife.

The culture and management of pastures, the principle of having enclosed paddocks for rotational controlled grazing are the same as found in the sheep stations. In the wetter districts a mixture of white clover and sub-terranean clover along with perennial rye grass, cocksfoot and Phalaris are sown in the pastures and the average carrying capacity was one cow per $2\frac{1}{2}$ acres. The development of perennial pastures in Victoria requires at least 25 to 30" of rainfall per annum. In irrigated districts, white clover predominates and an average paddock carries a cow per acre. Lucerne is also grown in many farms. During spring time when the growth of pasture far exceeds grazing by cows, the pastures are

These two merino rams are typical of the breeding stock on which Australia's vast flocks depend. Both these animals were bred on Haddon Rig, an extensive sheep property in New South Wales.

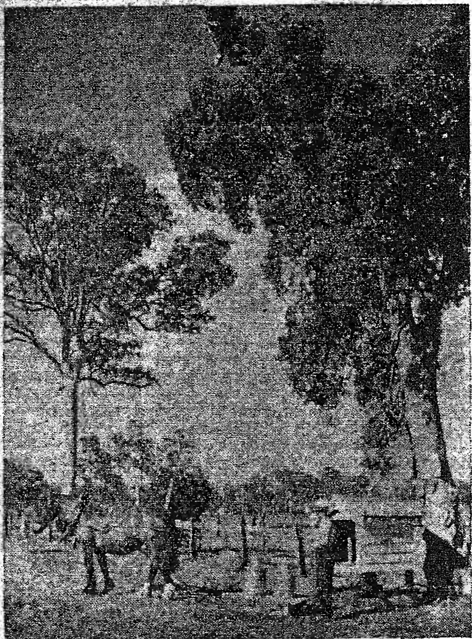
Australian News & Information Bureau.

Examining the fleece of a two-year-old Merino stud ram at Boonoke Station, New South Wales.

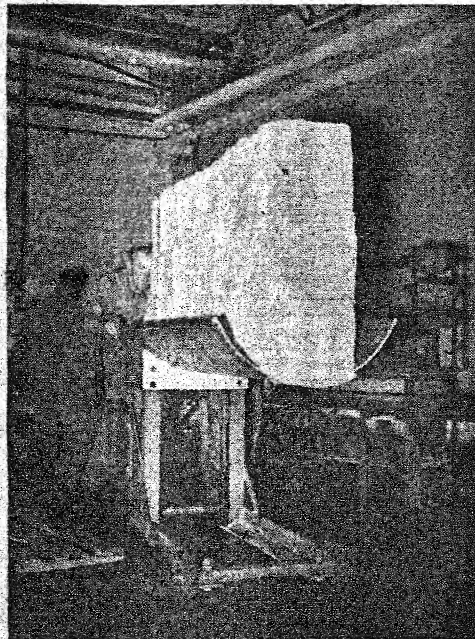


A Prize-winning Illawarra Shorthorn dairy cow. This breed, developed in Australia, and named from the New South Wales south-east district where they originated, are renowned for their milk production. The beast seen here, in eight 273-day lactations produced 103,000 lb. of milk, yielding 3,950 lb. of butter fact.
(Australian Information Bureau).

Shearers on the "board" at Wales handle on an average, 17,000 sheep each year. During a season, which lasts about 11 months, full-time shearers each handle about 20,000 sheep. When a shed is completed they move to another.



Cream is being delivered at a picking-up point.
Lower Southgate, N. S. Wales.



Butter being taken into cold store at an
Australian butter factory.

mowed and hay is baled and stacked for use in winter. A modern innovation is in the use of electric fences, to sub-divide each paddock, to allow strip grazing and to force the animals to feed close to the stubbles and thus avoid wastage of feed.

The cows are pictures of perfect health and satisfaction. They are there on the paddocks right through the year, grazing as they pleased and having at their will full access to water and shade. There is no let or hindrance in their way of life except during milking time, when they quietly enter the shed, part with the enormous burden of milk in their udders and quietly slip away back into the paddocks, the happier for being light in the hind quarters. Some farmers are in the habit of feeding the cows a pound or two each, of oats at the time of milking. Hand milking is too costly and cumbersome a method to be followed by the modern dairy farmer. The milking machines of stainless steel kept under conditions of good sanitation are there in every farm and takes only 6 minutes to milk a cow giving an yield of 4 gallons per milking. Some farmers send the whole milk to the factory while others separate the cream in their own premises and despatch the cream alone to the factory. In the latter case pig raising, to utilise the skim milk, is a profitable side line.

In this connection mention must be made of a gigantic milking plant we saw in Camden, N. S. W., the rotolactor plant in the possession of the Camden Park Estate Pty. Ltd., where 1500 cows can be milked every day morning and evening, at the rate of 350 cows per hour and employing only ten men to do the job. The plant is one of the two that exist in the world, the cost being £ 50,000/-. This firm has extensive grazing properties and specialises in supply of full milk to Sydney market.

There are two types of farmers, one specialising in supply of whole milk to the metropolitan areas and the other specialising in butter production. Their areas are clearly demarcated, though, in certain areas, they intermingle. The former invariably has a herd of Friesian or Ayreshire cows, which give the farmer a higher yield of milk (8,000 to 10,000 lbs. per lactation) of low butterfat content (3 to 4%). Basing their economy as they do on butter fat production, the latter prefer to have Jersey cows which are reputed to yield 5,000 to 7,000 lbs. of milk per lactation of 5 to 6% butter fat content.

Three herds of cows evoked our admiration. The Hawksbury Agricultural College, New South Wales, has a herd of fine Friesian cows and an outstanding cow in the herd averages 15,000 lbs. of milk per lactation. The Friesian cows at the Werribbee Experimental Station average 11,000 lbs. The Dookie Agricultural College, Victoria, possesses the finest Ayreshire pedigree cows (165 in number) averaging 10,000 lbs. per lactation of 300 days. The Australian Illawara Short Horn breed does splendidly well in the tropical and sub-tropical areas of Queensland and is well worth introduction and trial in India.

Whatever the breed of cattle a farmer chances to possess he invariably adheres to the following principles in the selection and maintenance of individual cows: (1) The cow shall yield a minimum of 7,000 lbs. of milk or 400 lbs. of butter fat per lactation. (2) The cow shall calve every year. (3) It should be amenable to milking by machines. Cows not conforming to the above requirements are culled.

A good bull is half the herd. The close attention the farmers pay in the selection proper bulls and the strict rules they observe in maintaining the purity of the type and the pedigree of the cows has paid them rich dividends. No effort is spared and no finance is withheld to introduce really good sires. The emphasis laid on the sires was well brought home to us when a few of us saw an outstanding bull of proved performance purchased by a firm of beef cattle breeders at a cost of £ 13,000. Herd testing of cows has become an established feature in many of the commercial dairy farms, some of which reported an average herd increase of as much as 75 lbs. of butter fat per lactation in so short a period of testing as 10 years.

As much as 90% of the total dairy production in the country is marketed through Dairy Farmers' Co-operative Societies scattered throughout the dairy areas. The Dairy Farmers' Co-operative Milk Company, New South Wales has a total annual turnover of £ 5 millions while the Co-operative Factory at Camperdown, Victoria has a turnover of £ 1·5 millions. The latter manufactures a variety of products including skim milk powder and casein and employs the most modern machinery. Rules and regulations regarding the details of construction of dairy buildings and maintenance of the sanitary condition of the premises, utensils and machinery in the factory and on the farm are very strict and are meticulously followed.

The Australian Dairy Produce Board, constituted under an Act of the Parliament, is the sole Australian Exporter of butter and cheese. For various political and economic reasons, the Australian Dairy farmers are unable, at the present time, to compete on equal terms with their counter-parts of other nations, specially the U. S. A., in the international markets. And since the Dairy industry is dependant upon the overseas markets for the disposal of 30% of her total dairy production, the Commonwealth Government have evolved a scheme of high internal market price (£ 420 per ton) and a subsidised export price of £ 400 per ton, the Commonwealth Government paying a subsidy of 9 pence for every pound of butter produced. The subsidy is to enable the farmer to get an over-all average price of 4 sh. 6 pence per pound of butter fat supplied to the factory, the minimum price which would allow the farmer to maintain a decent standard of living. The subsidy paid by the Commonwealth Government in the year 1955–1956 amounted to £ 14·5 million.

The pastoral industry of Australia, whether of dairy or beef cattle or sheep, is fortunate in more ways than one. Rain, though scanty in many areas, is evenly distributed. The land available for the industry is extensive, fertile and responds well to good management. Pioneers have evolved and modern breeders continue to evolve breeds of stock to thrive well on the sunny plains of the country, and maintain their purity and build up the pedigree through well-organised breeders' Societies. To crown them all, the stocks are entirely free from many of the contagious and infectious diseases which cause havoc in many other countries. Foot and Mouth, Haemorrhagic Septicemia and Rinderpest are entirely unknown. The quarantine regulations governing the entry of livestock from other parts of the world area so well laid out and so strictly administered that, for the past many decades, many diseases have been kept off the shores of Australia.

Groundnut — Mixed Cropping Experiment

by

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Introduction: Groundnut is one of the important commercial crops of the Madras State and it occupies nearly two million acres with an estimated production of one million tons of nuts in shell valued at nearly 33 crores of rupees. The area under groundnut has expanded phenomenally at the expense of other crops because of the ease of cultivation and the attractive monetary returns. Groundnut is grown pure and also extensively as a mixture with other cereals and pulses. The benefits of mixed cropping have been stressed by many agronomists. The practice is not new to the Indian ryot whose holding is small and a variety of crops is taken by resorting to judicious mixed cropping. However to get the best results out of mixed cropping subsidiary crops to be grown have to be chosen carefully to see that the components do not react adversely on each other.

Summary of previous work: Previous work done in this regard in the other States has been dealt at length in a previous paper on the subject by John, Seshadri and Shanker Rao (1943). At the Agricultural Research Station, Hagari (Andhra) Groundnut-*tenai* was found to be ecologically a sound mixture. At Guntur (Andhra) Cotton-groundnut mixture gave highest monetary return per unit area. Similar results were obtained at Dharwar (Bombay). Mehta (1942) reported that redgram and groundnut mixture was better than redgram sown pure. The same combination proved successful at the Agricultural Research Station, Siruguppa, (Andhra). Mixed cropping trials with cotton at the Agricultural Research Station, Koilpatti (Madras) have shown that groundnut, among the different mixed crops, has the least effect on cotton. Mixed cropping experiment was conducted at the Agricultural Research Station, Tindivanam (Madras) from 1939–'40 to 1948–'49. Results obtained in the first series of experiment from 1939–'40 to 1941–'42 have already been published and in this paper results obtained in the second series conducted from 1942–'43 to 1948–'49 are reported.

Materials and Methods: *(a) Treatments:* The experiment was conducted at the Agricultural Research Station, Tindivanam for

seven years (1942–'43 to 1948–'49) in two series. The main object of this experiment was to study the relative effects of the mixed cropping on the two main types grown in the country viz. spreading and the bunch.

I *Series (Bunch Groundnut) (1942–'43 to 1945–'46)*

Treatments	Strains	Spacings
1. Groundnut and Cotton	Groundnut TMV. 2	6" x 6"
2. Groundnut and Redgram	Cotton - Co. 4	3' x 9"
3. Groundnut and Castor	Cumbu - Local	3' x 6"
4. Groundnut and Cholam	Tenai - Local	3' x 6"
5. Groundnut and Tenai	Castor - TMV. 2	6' x 2'
6. Groundnut ann Cumbu	Redgram - Local	6' x 9"
	Cholam - Local	6' x 6"

II *Series (Bunch and spreading groundnuts)*
(1946–'47 to 1948–'49)

Treatments	Spacings Groundnut	Other crops
1. Groundnut (TMV. 2) - Bunch pure	6" x 6"	
2. Groundnut (TMV. 2) - Castor (TMV. 3)	6" x 6"	6' x 2'
3. Groundnut (TMV. 2) - Redgram P. S. Strain	6" x 6"	6' x 9"
4. Groundnut (TMV. 2) - Cholam - Local	6" x 6"	6' x 6"
5. Groundnut (TMV. 2) - Cumbu - Local	6" x 6"	3' x 6"
6. Groundnut (TMV. 1) - Spreading pure	9" x 9"	
7. Groundnut (TMV. 1) - Castor - TMV. 3	9" x 9"	6' x 2'
8. Groundnut (TMV. 1) - Redgram P. S. Strain	9" x 9"	6' x 9"
9. Groundnut (TMV. 1) - Cholam - Local	9" x 9"	6' x 6"
10. Groundnut (TMV. 1) - Cumbu - Local	9" x 9"	3' x 6"
11. Castor pure (TMV. 3)		3' x 2'
12. Redgram pure - P. S. Strain		3' x 6"
13. Cholam pure - Local		1' x 6"
14. Cumbu pure - Local		1' x 6"

The randomised method of layout was adopted. The net plot size after rejecting requisite borders was 44' x 6' or 1/165 acre in the first series and 33' x 6' or 1/220 acre in the second series.

(b) Cultivation details: The fields were cultivated as are usually done for the groundnut crop. Town rubbish was applied at the rate of 10,000 lb. per acre and was incorporated into the soil. Sowings were done in the proper seasons. Two hoeings and weedings were given to all the plots, the first during the fourth week and the second a month later. The bunch groundnut was harvested by pulling the plants and stripping the pods and the spreading variety by digging with mammuty and stripping the pods. After the harvest of groundnut H. M. Guntake No. 2 was worked in between the rows of Castor, Redgram and cotton to remove weeds.

(c) Season: First Series: The first series of the experiment was conducted during the four years 1942–'43, 1943–'44, 1944–'45 and 1945–'46. The first season though started late, was a favourable one for the bunch crop. Good distribution of rainfall during the earlier part of the season proved ideal for the bunch groundnut and very good yields were obtained. The rapid development of the groundnut plants affected the growth of the subsidiary crops and the short duration cereals were the worst affected. The second season (1943–'44) was characterised by increased activity of the north-east monsoon, which favoured only the long duration subsidiary crops. The groundnut crop was an average one. During the third season (1944–'45) immediately after sowing there was a heavy downpour which affected the germination of all the six subsidiary crops grown mixed with groundnut. Excessive rains delayed harvest of the groundnut crop and as a result large percentage of nuts sprouted in the field. The yields were erratic and hence discarded. The fourth season (1945–'46) was a normal one and fairly good yields were obtained.

Second Series: In the first year 1946–'47, groundnut was sown by the middle of July. Rainfall received during the crop period was in excess of the requirements. The distribution was also not altogether satisfactory. The yield of bunch groundnut was below normal. In the second year, 1947–'48, season was adverse to the spreading groundnut as the north east monsoon was a near failure. The distribution of rain during south west monsoon period was uneven and unsatisfactory. The yield of bunch groundnut was below normal while that of spreading groundnut was poor. In the final year 1948–'49, the season was marked by partial failure of both the south west and the north-east monsoons. Prolonged drought prevailed in the initial stages which greatly affected the growth of the crop especially that of bunch groundnut. The north-east

monsoon also failed and rendered harvesting difficult. The initial setback greatly upset the results of the experiment, especially in case of bunch groundnut.

Results: *(a) Yield:* The yield of groundnut grown as a pure crop and as mixture crop was recorded for all the seasons. The yield data were statistically analysed and the results are given in tables below, series wise.

TABLE I (a)

Mixed Cropping of Groundnut (1942 - '43 to 1945 - '46)
Groundnut Yield Data — (Average for three years)

Particulars	Groundnut Bunch-pure (Control) A	Groundnut and Cumbu B	Groundnut and Tenai C	Groundnut and Cotton D	Groundnut and Castor E	Groundnut and Redgram F	Groundnut and Cholam G	Standard error	Whether significant or not (P=0·05)	Critical difference
Acre yield in lb.	1,450	1,242	1,275	1,370	1,336	1,180	1,105	37·1	Yes	105·0
Percentage on Control	100·5	85·7	87·9	94·5	92·1	81·4	76·2	2·6	Yes	7·2

Conclusion : A, D, E, C, B, F, G.

TABLE I (b)

Groundnut mixed cropping experiment (1946—47 to 1948—49)
Yield of Groundnut in lb.—(Average for 3 years)

Second Series:

Treatment	Bunch TVM. 2		Spreading TVM. 1	
	Acre yield in lb.	Percentage on control	Acre yield in lb.	Percentage on control
Groundnut Pure	900	100·0	850	100·0
Groundnut and Cholam	519	57·7	485	57·1
Groudnut and Castor	722	80·2	764	89·9
Groundnut and Cumbu	689	76·6	606	71·3
Groundnut and Redgram	729	81·0	620	73·0
Standard Error	51·5	5·7	42·4	4·9
Whether Significant or not (P=0·05)	yes		yes	
Cretical difference	145·6	16·2	120·0	14·1

Conclusion: Groundnut, Redgram, Caster, Cumbu, Cholam
Groundnut, Castor, Redgram, Cumbu, Cholam

TABLE II (a)

Mixed Cropping Experiment

Yield of subsidiary crops when grown with bunch groundnut

First series :

Treatments	Yield in lb. per acre		
	1942 — '43	1943 — '44	1945 — '46
Castor	147	420	87
Cumbu	59	360	221
Tenai	32	354	307
Cholam	128	710	631
Cotton	82	121	76
Redgram	261	317	600

TABLE II (b)

Yield in lb. per acre

Second Series :

Years	Treatments	Pure	When grown with bunch groundnut	Percentage on pure crop	When grown with spreading Groundnut	Percentage on pure crop
1946'–47	Cholam	248	327	131·9	308	124·2
	Castor	254	93	36·6	184	72·4
	Cumbu	590	186	31·5	375	63·6
	Redgram	488	152	31·1	227	46·5
1947–'48	Cholam	822	529	64·3	666	81·0
	Castor	940	288	30·6	536	57·0
	Cumbu	590	70	11·8	68	11·5
	Redgram	822	375	45·6	330	28·0
1948–'49	Cholam	407	237	58·2	319	78·3
	Castor	228	71	31·2	106	46·5
	Cumbu	262	65	24·8	108	41·2
	Redgram	1196	210	17·6	303	25·3

(c) Economics: The economics of growing groundnut as a pure crop and as a mixture crop was worked out in each of the years of the first series of experiment. The results are given below :

TABLE III

Economics of Cultivation on acre Basis in Rupees

Particulars		Groundnut pure (Bunch)	Groundnut Cumbu	Groundnut Tenai	Groundnut Castor	Groundnut Cotton	Groundnut Redgram	Groundnut Cholam
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1942–'43:	Cost of cultivation	31	35	36	37	34	36	35
	Gross return	71	60	62	77	77	76	63
	Net Profit	40	25	26	40	43	40	28
1943–'44:	Cost of cultivation	33	38	38	38	37	38	36
	Gross return	64	70	69	69	86	72	63
	Net Profit	31	32	31	31	49	34	27
1945–'46:	Cost of cultivation	60	65	69	69	66	69	68
	Gross return	135	152	157	150	150	173	155
	Net Profit	76	87	88	81	84	104	87
Average for three years:								
	Cost of cultivation	41	46	48	48	46	48	46
	Gross return	90	94	96	99	104	107	23
	Net Profit	49	48	48	51	58	59	47

The gross return was calculated by taking into account the value of groundnut produce, haulms, produce of the mixed crop, at the prevailing market prices.

Discussion: *(a) Yield of groundnut: First Series:* In the first year, cotton and castor had very little effect on the yield of groundnut, but the other crops reduced the yield significantly. In the second year, there was significant reduction in yield of groundnut compared with pure groundnut due to the effect of mixed cropping in all cases. But castor and cotton had comparatively lesser effect. In the final year, only redgram and cholam had diminished the yields and the rest had little or no effect. The combined analysis of the three years data showed that the treatment effects were statistically significant independent of seasonal differences. It is evident from the results that the yield of groundnut gets reduced when raised as a mixture crop and that in all the three years *Cholam* caused the maximum reduction (23·8%). The percentage of depression in the yield of groundnut crop is not as much as recorded in the previous series of experiment with spreading groundnut reported by John et al (1943).

Second Series: In the second series the differences in the yield between the crop raised and that grown mixed with other crops were statistically significant only in the first two years. In the first

year, the mixtures of 'Groundnut and Castor' and 'Groundnut and Cumbu' recorded significantly higher yields over the mixture "Groundnut and Cholam" in the case of both bunch and spreading groundnut. In the second year 'Groundnut and Cholam' mixture recorded significantly less yields than all the other treatments in the case of bunch groundnut. In the case of spreading, groundnut pure and "Groundnut-Castor" mixtures recorded significantly higher yields than 'Groundnut and Cholam'. In the third year (1948—'49) the yield differences did not satisfy the 'Z' test. Combined analysis of the data for the three seasons revealed that cholam when grown as mixture with groundnut either bunch or spreading depressed the yield of groundnut significantly than other crops.

Comparing the effect of other crops on the bunch and spreading types it is seen that bunch crop suffers lesser reduction in yield than the spreading groundnut particularly when grown mixed with cumbu and redgram. The percentage of reduction in yield of bunch and spreading groundnut when grown mixed with other crops are given below in Table IV for each year and also the three year average.

TABLE IV

Mixed cropping experiment reduction in yield of groundnut

	Bunch Groundnut	Spreading Groundnut
1946—'47 :		
With Cholam	36·3	42·3
With Castor	8·3	8·2
With Cambu	6·6	3·5
With Redgram	23·4	31·0
1947—'48 :		
With Cholam	45·6	48·8
With Castor	10·9	2·1
With Cambu	21·7	48·4
With Redgram	24·0	32·8
1948—'49 :		
With Cholam	44·6	37·9
With Castor	43·8	18·0
With Cumbu	43·5	32·1
With Redgram	19·3	17·1
Average for three years :		
With Cholam	42·2	43·0
With Castor	21·0	9·4
With Cumbu	23·9	31·3
With Redgram	22·2	27·0

(b) Yield of other crops: First Series: None of the subsidiary crops has given consistently good yields in all the three seasons. In the second year when the season was adverse for the bunch groundnut all the subsidiary crops have fared fairly well. The wide variations in the yield of subsidiary crops are not only due to the seasonal effect. The bunch groundnut crop being very vigorous in the initial stages especially in years when the rainfall distribution is favourable as in 1942—'43, the growth of the subsidiary crops is much affected and it is only after the harvest of the main crop (groundnut) that the other crops pull up. The average of the yields of the subsidiary crops are low compared with the yields of the same crops during the previous three years when they where raised as mixture with the spreading groundnut. This leads to the conclusion that other crops do not fare well when mixed with bunch groundnut.

Second Series: The yields of subsidiary crops were compared when raised mixed with bunch and spreading groundnut by expressing them as percentages on the yield of pure crops raised in the same season. The data are given below in Table V

TABLE V

Yield of Subsidiary crops 'Average of three years' expressed as a percentage of the pure crop

	Cholam	Castor	Cumbu	Redgram
With bunch groundnut	84·8	25·9	22·8	31·9
With spreading groundnut	94·5	45·1	38·8	33·3

From the above data it is seen that the bunch groundnut has greater depressing effect on the yield of other crops forming the mixtures than the spreading groundnut.

(c) Economics: 'Groundnut plus cotton' mixture has given the maximum returns, in two of the three years and the mixture 'Groundnut and Redgram' in one year. As the subsidiary crops failed badly, the mixtures groundnut plus Cumbu and groundnut plus Tenai have given lesser returns than the pure crop of groundnut. Mixed cropping of groundnut with castor and redgram has given high returns consistently and these may profitably be adopted by ryots. Groundnut and cotton mixture may specially recommended in view of the extention programme in Cotton.

The results obtained from this experiment are in conformity with the results obtained in the experiments carried out with the bunch and spreading groundnuts separately.

The principle underlying the practice of mixed cropping is not only to get maximum returns from an unit area but also to utilise the soil fully and in a proper way. By growing two crops with two different feeding zones the soil is fully exploited. For this, both the crops must have fair opportunities to develop. Groundnut is a shallow rooted crop and crops like Redgram, Castor and Cotton with deeper root systems are better suited to mixed cropping. The bunch groundnut on account on its initial vigour, over grows the young crops sown with it and inhibits their growth. This results in low yield of the subsidiary crops. Though the fact that it undergoes lesser reduction in yield is an advantage in favour of bunch groundnut, its effect on the subsidiary crops is not negligible enough to be over looked. It can safely be concluded that spreading variety of groundnut is more suited to mixed cropping with other crops than the bunch.

Conclusion: The following conclusions are drawn from the experiments:

1. The bunch groundnut suffers comparatively smaller depression in yield than the spreading groundnut when grown mixed with other crops.
2. The bunch groundnut has greater depressing effect on the yield of other crops forming the mixtures than the spreading groundnut.
3. Of the subsidiary crops forming mixtures, Cholam causes the maximum reduction in yield of the groundnut.

Based on the above conclusions the following recommendations are made:

1. Mixed cropping is remunerative than pure cropping.
2. The spreading variety of groundnut is more suited to mixed cropping.
3. The following mixtures are more economical th n others
   Groundnut and Castor.
   Groundnut and Redgram.
   Groundnut and Cotton.

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The Response of Rice to Lime and Potash Manuring in South Kanara

by

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Introduction: Rice is the most important crop of South Kanara forming 70% of the total area sown and occupying about 5·6 lakhs of acres. The heavy annual rainfall of over 150 inches received within a short spell of four months subjecting the soil to a constant process of leaching, the slopy situation of the land, high temperature and humidity, all have contributed to the extremely low fertility status of the soil of this tract. As such the yield of not only rice but also most of the other food crops has been miserably low.

As is well known the adequate manuring of field is an all-important factor in rice production and phenomenal yields have been recorded by adequate manuring in recent years. An average rice crop removes about 28 lb. N, 20 lb. P205 60 lb. K20 and 28 lb. Ca0 and if normal crop production is expected year after year it is quite but natural that these nutrients have to be supplied in adequate quantities. Of the three major plant nutrients namely nitrogen, phosphoric acid and potash the response of paddy to nitrogen has been universal. Though the response with phosphoric acid fertilizers has been somewhat veriable it is being widely used in all rice growing countries. Although potash is not widely used for paddy except in Japan, response to this plant nutrient has been reported from a number of countries.

It is generally believed that potash manuring is not needed for Indian soils mainly due to the fact that soil analysis shows fairly large quantity of the same. In South Kanara there exists the common practice of applying liberal quantities of ash to paddy as well as to all other crops. Besides ash, they also use burnt earth or '*Sudumannu*' in large quantities to nurseries, vegetable crops etc. In Malabar also wood ash is applied economically for upland rice, in dry nurseries and for broadcast rice in wet lands.

An important factor in maintaining high productivity in rice soils is the base status and pH of the soil. Application of lime has to be considered as the back bone of good crop production in all humid regions where leaching removes lime from the soil. Chemical analysis reveals a decidedly acidic reaction and a low lime status in

the soil of South Kanara and addition of lime to this soil at fairly high levels has already been proved beneficial. But the cost of lime at such high levels in so prohibitive that it is out of proportion to the advantage gained. Having known the beneficial effects of lime it will be worth-while to find out the response of paddy to lime at lower levels. An observation trial was therefore laid out at the Paddy Breeding station, Mangalore to find out how far paddy responds to application of potash and lime at lower levels.

Review: Mukherjee H. N. and Sinha P (1953) found that potash in combination with nitrogen and phosphoric acid could increase the yield of paddy by two to three maunds per acre in almost all soil types of the Bihar State. In Assam potash significantly increased the yield of paddy not only in the year of application but also left a good residual effect. In China the response to potash was greatest on acid sandy loam and alluvial soils and least on alluvial soils. In Malabar in the case of transplanted swamp rice some yield increase has been recorded by wood ash application. Application of potash was also found to confer some resistance against stem rot, helminthosporium and blast in some centres though in Madras potassium sulphate and super phosphate either alone or in combination with nitrogen was found to have no effect. In water culture application of potash 35 to 45 days before heading increased the number of grains and weight of 1000 grains. In Japan one third of N, P and K is applied dry before puddling and the remainder in two portions three to four weeks after transplanting and two to three weeks before ear emergence. It is also reported that potash deficiency symptoms occur in soils which according to analytical data were well provided with all nutrients. Besides, potash has been found to be complementary to nitrogen, the latter increasing leaf's size and the former its efficiency. Potash also increases the plant's resistance to drought.

The results of the experiment with lime conducted at the station showed that application of lime at doses of 1000 to 3000 lb. per acre results in increased grain yields. Small applications of lime proved more effective per unit used than large doses, lime leaching losses increasing roughly in proportion to the quantity applied. Besides smaller applications were found to bring about greater pH change and larger crop response per unit of lime applied than heavier applications. Lime has also the indirect beneficial effect in that it speeds up the mineralization of organic matter and thus makes nitrogen available to the paddy crop. Heavily leached

soils of North Aukland were found to show response to potash only when the lime and phosphate content of the soil has been built up.

Experimental: An observational trial was laid out with two treatments, one the usual farm manuring consisting of 5000 lb. of leaf and 150 lb. of super phosphate both applied as basal dressing and 30 lb. nitrogen as Ammonium sulphate applied in two equal doses one three weeks after planting and the other six weeks after planting and the other treatments consisting of the application of 100 lb. lime and 15 lb. potash in the form of muriate of potash over the normal farm manuring. Lime was applied 10 to 12 days before planting and potash in two split doses, half at planting and the other half six weeks after. The trial was conducted during both the first and second crop seasons of 1955—'56. During both the seasons of trial all the quantitative factors contributing for yield like number of productive tillers, length of panicle, number of grains per panicle, number of chaff per panicle, length, breadth and thickness of grain and weight of 1000 grains were recorded in both the treatments. The economics of application of the ingredients was also worked out during both the seasons. The data are presented below:

Particulars (mean)	I crop 1955 – '56 Variety: MGL. 3		II crop 1955 - '56 Variety: PTB. 20	
	Farm manuring	Farm manuring + 100 lb. lime + 15 lb. K20	Farm manuring	Farm manuring + 100 lb. lime + 15 lb. K20
Tillers (1 month after planting)	5·6	9·1	6·7	9·2
Height (,,)	33·6″	38·5″	24·2″	28·4″
Tillers (after flowering)	3·3	4·4	4·1	4·8
Height (,,)	61·1″	64 8″	35 3″	36·2″
Length of panicle	20·0 cm.	21·9 cm.	13·6 cm.	15·4 cm.
No. of grains/panicle	82·6	86·0	63·5	65·1
No. of chaff/panicle	12·4	12·1	8·8	5·5
Length of grain	7·80	8·30	7·95	8·18
Breadth of grain	3·10	3·10	2·98	2·99
Thickness of grain	2·20	2·30	2·01	2·15
Weight of 100 grains	27·92 grms.	28·64 grms.	26·75 grms.	27·39 grms.
Acre yield of grain in lb.	2454	2695	2184	2312
% increase	100	109·8	100	105·8
Value of extra produce – Rs.	..	26–11—0	..	14—3—6
Cost of 100 lb. lime and 25 lb. muriate – Rs.	..	7—2—0	..	7—2—0
Net profit per acre – Rs.	..	19—9—0	..	7—1—6

Discussion: From the table it is seen that application of lime and potash has increased the yield by 9·8% and 5·8% during the first and second crop seasons respectively. The number of tillers and height both one month after planting and after flowering, length of panicle and number of grains per panicle are more in plots receiving lime and potash. The size of grain especially length and thickness and weight of 1000 grains has been found to be increased by the application of lime and potash, an effect noted to be brought about by the application of potash alone. It was also interesting to note that during the crop growth in the first crop season plants in plot receiving farm manuring alone started lodging about ten days in advance than those in the other plot. Besides it is also seen that the application of these two manurial ingredients has got definite economic advantage also.

The fact that the heavily leached soils of North Aukland showed response to potash only when the lime and phosphoric acid content of the soil was sufficiently high may be one of the reasons for the poor response of potash so far obtained in the lateritic soils of West Coast which are highly deficient in lime. Adoption of the age long practice of applying ash and Sudumannu in South Kanara for rice as well as for other dry crops and the application of wood ash in Malabar for upland rice, for dry nurseries and for broadcast rice in wet lands may not be merely with the object of conservation of soil but with the object of helping the crop to utilize soil moisture more advatageously. Moderate application of lime practiced over a period of years is likely to have better advantages than heavier doses applied at longer intervals since the solubility of most of the minor elements is reduced by such heavy applications.

The application of a single element to the soil is usually found to be beneficial only within fairly narrow limits. This is but to be expected, for such single addition if applied in quantity must upset the balance of fertiliser materials in the soil. Since the amount of one element which the plant can absorb depends on this balance it appears that the future investigations on the manurial aspect of rice has to be so orientated as to include not only the major plant food elements N, P and K but also other soil amendments such as lime and minor elements so as to determine the optimum quantities of each ingredient to fix up a balanced manure.

Summary: Under the soil conditions existing in South Kanara, rice is found to respond to application of potash and lime at low

levels in combination with nitrogen and phosphoric acid. From the various attributes studied it is seen that there is increase in the different quantitative characters contributing for yield due to application of potash and lime. Due to the fair margin of profit the proposition is economically sound.

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A Note on the Variations of Soil Temperature at Coimbatore

by

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Introduction: Ramdas and Dravid (1) studied the variations of soil temperatures at Poona using soil covers of different colours. Dravid (2) has stated that Poona black cotton soil absorbs 84 per cent of the incident solar radiation while Sakrand soil absorbs only 59 per cent, by virtue of the difference in their colours. At the Central Farm, Coimbatore, black, red and alluvial soils (Tank silt) exist side by side and crops are grown on all of them. The three types of soils may be have differently to the same incident solar radiation. In the following note, the results of the study on the variations of surface soil temperature on the above three agriculturally important soils are summarised.

Materials and Methods: Red and black soils and tank silt were respectively filled and compacted in three pits of $2' \times 2' \times 2'$ prepared in the Agricultural Metreological Observatory, Coimbatore. Surface soil temperatures were recorded daily at 0735 Hrs. and 1435 Hrs. Indian Standard Time from 19—11—53 to 21—9—54. The three plots were kept barren and free from growth of any weed.

Correlation cœfficients worked out, separately for the months November 1953 to September 1954, between the maximum temperature attained during the day in the Stevenson screen and the surface soil temperatures at 1435 Hrs. in the red and black soils and tank silt plots respectively are presented in Table I. Similarly, correlation cœfficients, worked out between the minimum temperature recorded during the day and surface soil temperatures recorded at 0735 Hrs., in the three plots of soils, mentioned above, are given in Table II. The diurnal variation of surface soil temperature in these three different types of soil for each month is indicated in Table III.

Discussion: When the experiment was commenced it was expected that the black soil would record high temperatures in the afternoon, by virtue of its colour, but it is seen that tank silt has recorded higher values of temperature, as shown in Table III. The highest values of surface tempatures recorded by the three types of soils are: (1) Red Soil 63·9°C. on 3—4—1954; (2) Black soil 64·5°C. on 6—4—1954; (3) Tank silt 65·9°C. on 6—4—1954.

It may be noted that the surface soil tempature was higher in tank silt than in the black soil at 1435 Hrs. on 6—4—1954. Table III indicates the nature of diurnal variation of surface temperature and as to how it depends mainly on the colour of the soil.

TABLE I.

Values of cœfficients of correlation between maximum temperature in the screen and surface soil temperature at 1435 hrs.

Month		Red Soil	Black Soil	Tank silt
November	1953 *	0·8082	0·8463	0·7889
December	1953	·6918	·7657	·8336
January	1954	·7616	·8095	·7703
February	,,	·8695	·8105	·8331
March	,,	·8205	·7885	·7842
April	,,	·8287	·8014	·7743
May	,,	·7420	·7465	·7295
June	,,	·8926	·9100	·8569
July	,,	·7257	·7111	·7567
August	,,	·8230	·8258	·8534
September	,, £	·6221	·5716	·6015

Remarks: * Only for 12 days from 19—11—1953.
£ Only for 21 days from 1—9—1954.

TABLE II.

Values of cœfficients of correlation between minimum temperature and surface soil temperature at 0735 hours.

Month		Red Soil	Black Soil	Tank silt
November	1953 *	·2271	·3626	·2504
December	1953	·6257	·6248	·5361
January	1954	·7559	·6746	·5981
February	,,	·8791	·8683	·9346
March	,,	·9008	·8961	·8935
April	,,	·6418	·6125	·5982
May	,,	·6920	·7062	·6734
June	,,	·3302	·2724	·0802
July	,,	·2906	·1883	·0806
August	,,	·5082	·5154	·4689
September	,, £	·1807	·0015	·0860

Remarks: * Only for 19 days from 12—11—1953.
£ Only for 21 days from 1—9—1954.

TABLE III.

Diurnal Variation of Surface Soil Temperature.

Month	Red Soil	Black Soil	Tank silt
November 1953 *	14·6	17·0	16·7
December 1953	21·7	23·5	23·1
January 1954	21·5	21·3	22·6
February ,,	30·4	30·2	32·2
March ,,	26·9	27·3	28·5
April ,,	26·0	25·4	25·9
May ,,	20·1	18·5	18·4
June ,,	12·8	11·6	10·3
July ,,	12·6	11·8	11·2
August ,,	14·9	13·8	14·1
September ,, £	16·9	14·3	14·5

Remarks: * Only for 12 days from 19—11—1953.
£ Only for 21 days from 1—9—1954.

The diurnal variation of surface temperature of black soil is higher than either red soil or tank silt in November and December. It is the highest in tank silt in January, February and March while from August to September, it is the highest in the red soil.

From the Cœfficients of correlation between maximum temperature and surface soil temperatures of the three types of soils, presented in Table I, it may be seen that all of them are significant, indicating that the increase in the maximum temperature causes an increase in the surface temperature in all the three types of soils, as both are factors influenced by solar radiation. Further, the highest correlations are obtained in all the three types of soils in June 1954. As all the correlations are in general, highly significant it will be possible to calculate with a fair amount of success, the temperatures that may be attained by the respective soils, taking the screen maximum temperature into account.

The correlations between the minimum temperature, recorded in the Stevenson Screen, and the surface soil temperatures, recorded at 0735 Hrs., are not significant in the months of November 1953 and June, July and September 1954. During the other months they are significant for all the three typs of soils and the highest correlation cœfficients have been obtained in March. These factors indicate that only during the period December to May, the surface soil temperatures at 0735 Hrs., are proporational to the minimum temperature, recorded in the screen.

Summary and Conclusions: (i) The physical and chemical properties of soils play an important role in the absorption and disposal of solar energy, in addition to the colour of the soil.

(ii) High coefficients of correlation exist between maximum temperature and surface soil temperature at 1435 Hrs., in the three types of soils in all the months while the correlations between minimum temperature and surface soil temperature at 0735 Hrs. are not significant in the months of November, June, July and September.

(iii) The diurnal variation of temperature varies differently in the three soils in the different months.

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Synthetic Ion Exchangers (Amberlite Resins) Purify Water

by

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Water is chiefly used for domestic purposes, for irrigation and in industry. Yet, the same quality of water will not meet all purposes. The total solids should not exceed 500 ppm. for a water of good chemical quality for drinking purposes (U. S. Public Health Service Drinking Water Standards, 1946). Among the ions, bicarbonate is preferable to carbonate, sulphate and chloride, and calcium to sodium. For industrial purposes, waters containing calcium and magnesium salts are undesirable because such waters cause boiler-scale and corrosion of the material. Irrigation water is usually judged by three criteria; (a) boron atom concentration, (b) the ratio of sodium ion content to the sum of sodium, magnesium, calcium and potassium ions and (c) total dissolved salts. The following table gives the permissible limits for total solids and percent sodium of several classes of irrigation water as generally adopted in the U. S. A. (1).

Classes of water Grade	Approximate limits for dissolved solids	Percent sodium $(\%Na = \frac{Na \times 100}{Na + K + Ca + Mg})$
1. Excellent	Less than 175 ppm.	<20
2. Good	175 to 500 ,,	20 to 40
3. Permissible	500 to 1400 ,,	40 to 60
4. Doubtful	1400 to 2100 ,,	60 to 80
5. Unsuitable	Over 2100 ,,	>80

Although some irrigation waters may contain higher amount of dissolved salts the injurious effect is mitigated to an extent if calcium ions predominate. Sulphate and chloride ions are preferable to carbonate and bicarbonate. Thus the quality of water desired varies with the purpose.

The character of water depends to a large extent on the source; river water differs from lake water; lake water differs from well water, and so on. The rivers rising in mountainous regions usually have less dissolved salts and those flowing in arid desert regions collect salts from the strate in which they flow. Waters from the mineral springs are usually fortified with mineral salts and the claims made regarding the curative effect of such waters for certain ailments are not wholly without justification. The impurities (dissolved salts) which must be removed from water depend on the use for which water is intended.

There are several methods for the purification of raw water, from simple mechanical filtration through sand beds adopted in municipalities, to the most modern method of electrodialysis. The latter process consists in the removal of salts from a liquid flowing between pairs of ion-selective membranes by means of an electric field. As a point of interest it may be mentioned that the research on de-salting of saline waters by electro-dialysis is well advanced in the Netherlands (2) In an interesting treatise, Ellis (3) has examined the possibilities of extracting fresh water from the Ocean on a large scale with particular reference to plant construction, operating labour, maintenance, raw meterials and power. The synthetic resinous ion exchangers are the latest in this field and these are found to be eminently suitable to purify water to any desired degree, chiefly because of their high exchange capacity, their ability to withstand extremes of temperature, chemical condition and continued operation. However, their use is not limited to this field only. They are used for various other purposes also.

These resins are synthetic polymers, which are bead-like or granular particles about 0.5 mm. in diameter. Although the resins are insoluble, they react much as acids, bases or salts, but they differ from the latter in that only cations or anions are free to take part in chemical reactions. Thus, in the cation exchange resins, the anions are fixed and irreplaceable, and similarly in anion exchangers, the cations are fixed and irreplaceable. The exchangeable ion in the resin can be almost any ion. There are "single-bed" resins which are capable of ion exchange either anionic or cationic, as well as "multiple or mixed bed" resins capable of both cationic and anionic exchange simultaneously. The greater choice of these resins confirms on them almost unlimited use. Ion exchange columns are conventionally operated downflow by passing the solution to be treated through the resin bed from top to bottom and operated at a low flow rate usually (4, 5). But it is quite possible to operate in some mixed bed systems at high flow rates also (6). When the resin is exhausted of its exchangeable ions, it is regenerated by a simple process. The exchanger column is flushed with a strong solution of the ion in particular, say, if the cation exchange resin is of the sodium, the solution usually used is sodium chloride. Sodium replaces all the cations absorbed on the resin and thus the resin becomes fully regenerated. It is then resined and ready for use again and thus the ion exchange resin can be used over and over again (7). Besides, the resins achieve economy in operation cost and space, the results are completely satisfactory and regeneration can be carried out at an inexpensive cost.

The use of ion exchangers in industrial plants in advanced countries for softening of raw water is widespread (8, 9, 10, 11), Softening of water can be successfully done by passing water through a column of cation exchange resin of sodium form when the following reaction takes place:

$$\underset{\text{Resin}}{R\left|\begin{array}{l}Na\\Na\\Na\\Na\end{array}\right.} + \underset{\text{Hard water}}{\begin{array}{r:l}Ca & CO_3\\Ca & HCO_3\\Mg & SO_4\\Mg & Cl\end{array}} \longrightarrow \underset{\text{Resin}}{R\left|\begin{array}{l}Ca\\Ca\\Mg\\Mg\end{array}\right.} + \underset{\text{Hard water}}{\begin{array}{r:l}Na & CO_3\\Na & HCO_3\\Na & SO_4\\Na & Cl\end{array}}$$

The cations, calcium and magnesium from water are absorbed on the resin and sodium ions are released from the resin. The water coming out of the exchanger column contains non-hardness producing sodium salts only.

The usefulness of ion exchangers in the preparation of chemically pure water is perhaps unexcelled. Deionization with mixed bed resin is capable of producing water of exceptional quality (12, 13, 14). The technique merely involves the passage of water through an intimate

mixture of a cation exchanger of the hydrogen form and an anion exchanger of the hydroxyl form and the reactions taking place may be represented as follows:

STAGE 1

$$\underset{\text{Resin (H-form)}}{R\left|\begin{array}{l} H \\ H \\ H \\ H \end{array}\right.} + \underset{\text{Water with salts}}{\begin{array}{l:l} Ca & CO_3 \\ Mg & HCO_3 \\ K & SO_4 \\ Na & Cl \end{array}} \longrightarrow R\left|\begin{array}{l} Ca \\ Mg \\ K \\ Na \end{array}\right. + \underbrace{\begin{array}{l:l} H & CO_3 \\ H & HCO_3 \\ H & SO_4 \\ H & Cl \end{array}}$$

STAGE 2

$$\underset{\text{Resin (OH-form)}}{R\left|\begin{array}{l} OH \\ OH \\ OH \\ OH \end{array}\right.} + \begin{array}{l:l} H & CO_3 \\ H & HCO_3 \\ H & SO_4 \\ H & Cl \end{array} \longrightarrow R\left|\begin{array}{l} CO_3 \\ HCO_3 \\ SO_4 \\ Cl \end{array}\right. + \underset{\text{Ion-free water}}{\begin{array}{l:l} H & OH \\ H & OH \\ H & OH \\ H & OH \end{array}}$$

The cation exchanger adsorbs Ca^{++}, Mg^{++}, K^{+} and Na^{+} ions and releases an equivalent of hydrygen ions. The anion exchanger adsorbs HCO 3−, Cl−, CO 3−− and SO 4−− ions and releases an equivalent of hydroxyl ions. The released hydrogen and hydroxyl ions combine and flow out of the exchanger column as chemically pure water. Both cationic-and anionic-exchange resins can be used to remove fluorides, boron and other harmful ions from contaminated water (15).

Besides purification of water the ion exchangers are used for a variety of purposes and some of them may be indicated. Metallic ion residues from crop protection chemicals may be removed from crushed fruit syrups. Valuable ascorbic acid can be recovered from citrus wastes by the use of suitable anion exchanger. The ion exchangers clarify, demineralise and decolorise sugar solutions resulting in increased purity of the juice as well as the increase in yield of sugar (16, 17, 18, 19). In recovering precious metals from solutions, the resinous exchanger may be used to remove the metallic ion until the capacity of the resin is depleted, after which the resin is ashed to recover the metal. The resins are insoluble, non-toxic and non-irritating, and hence are valuable therapeutic agents. They are used in the treatment of gastric and duodenal ulcers and for reducing sodium connцentration in patients with hypertension. Evidence is coming of late that the resins are used in fertility studies and Research in agriculture (20, 21).

Thus the synthetic ion exchangers have simplified a number of processes and methods in chemical technology which were rather exacting and complicated.

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Research Note

Insecticidal properties of the common Indian Aconite*

Aconites belong to the Natural Order *Ranunculaceae* and comprise of about 180 species growing in the north temperate zone. It has over 50 European species and 24 Indian varieties that have shown to contain active alkaloids. The word aconitum, the classical greek name, is derived from "Akwan", a dart, from its having been used to poison darts. The roots powdered and formed into a sticky paste with water, was smeared over the arrow heads for striking the darts (Chopra 1933). Gomilevsky (1916) determined that a few drops of a strong water extract from the roots of *Aconitum mapellus*, dropped upon the body of the stag beetle, *Lucunus cervus*, were fatal. Mc Indoo and Sievers (1924) experimented with roots, leaves and stem of *Aconitum columbianum* and reported that it had no effect on grasshoppers as a stomach poison and applied as dust it was ineffective against bees.

The common Indian aconite is *Aconitum ferox*, as most of the roots sold under the name of "Bish" locally by herb vendors is derived from this variety. This species of aconite grows abundantly in India, mainly confined to the eastern temperate regions of Himlayas eastward of Kumaun at an altitude of 10,000 to 14,000 feet above the sea level. According to Stapf (1905) it has nearly double the quantity of the alkaloidal contents than those present in the *Aconitum napellus*, a European variety. In order to determine the insecticidal properly of the roots of *Aconitum ferox*, studies were under-taken and the results as appeared in the preliminary tests are presented in this paper.

The roots of the common Indian aconite, *Aconitum ferox* were obtained from the Director, Botanical Survey of India, Calcutta. The roots were made into chips of about one inch in size. The chips were oven dried and prepared for the tests on insects in two forms, (1) in a dry finely powdered condition, and (2) in the form of hot water extract. In all cases the material was thoroughly dried and then reduced to a powder. When the material was used for dusting it was made very fine so as to pass through a 70 mesh sieve. Hot water extracts or decoctions were prepared by boiling the powdered material with water for 2 hours. These extracts were concentrated or diluted as desired by evaporating the liquid or adding more water to it. The decoction was sprayed cold after straining the extract in a fine cloth. The powdered material was used by dusting it on wet foliage of the food plants of the test insects.

Three species of aphids, wheat aphis, *(Aphis maidis)* mustard aphis, *(Siphocoryne indobrassicae)*, and radish aphis, *(Rhopalosiphum*

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* A portion of the week done under the Vegetable Insecticide Investigation Scheme financed by the U. P. Scientific Research Committee, Lucknow.

pseudobrassicae) were tested by spraying the water extracts on them. Four species of chewing insects mustared saw-fly larva *(Athalia proxima)*, red pumpkin beetle *(Aulacophora foveicollis)*, kharif grasshopper. *(Hieroglyphus nigrorepletus)* and banded blister beetle *(Mylabris phalerata)* attacking mustard, gourd, juar, and pumpkin respectively were tested for stomach poison by dusting on the wet foliage. As far as possible the insects were sorted to size of the same age. The chewing insects were starved for one day before they were released on the dusted foliage for test. Four replications were used in each trial.

The trials indicate that the spray material when used at 30 gms per 1000 c. c. of water is able to control 50% of all the three types of aphis infestations. Higher mortality is obtained with the further increase in the doses. The wheat and the radish aphids appear to be more susceptible to these sprays than the mustard aphis.

The results show that the dust possesses an appreciable degree of toxicity to kharif grasshopper, red pumpkin beetle and mustard sawfly larvae. It is able to control over 56% of these test insects. The toxicity of this powder to banded blister beetle is, however, very low as compared to the other insects tested.

Although these preliminary tests indicate the possibility of usage of aconite as an insecticide, it might be well concluded that *Aconitum ferox* undoubtedly possesses a physiologically active form of alkaloid which is capable of killing insects. The experiments have shown that the roots of this plant are toxic to a considerable degree to several species of insects, either as stomach or as contact insecticide.

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A Note on the Extraction of Seeds from the Pods of Prosopis juliflora.

Prosopis juliflora otherwise known as 'Mesquite' is largely grown as a fence plant around fields, orchards and gardens to prevent cattle trespass and as a protective live fence. The extraction of seeds from the pods has been a difficult problem. The usual method of extraction is through pounding the dry pods in a mortar with wooden pestle (Ponnaya, 1954). Harbajan Singh (1954) states that treating the pods in hot water at 70° for 10 minutes before sowing helps to get a good germination.

With the object of evolving an easier method for the extraction of the seed by employing fungal agencies, studies were under taken in September 1955 at the instance of the then Director of Agriculture Sri M. S. Sivaraman, I. C. S. who happened to notice some old pods in which the seeds were found exposed through a slit like opening in the leathery pericarp due to the infection by fungus. The fungus *Macrophoma* Sp was isolated from the infected pods and this as well as other cellulose decomposing group of fungi such as *Aspergillus* sp, *polyporus* sp and *polystictus* sp were used in the studies for infecting the pods under artificial conditions in the laboratory. It was observed that the fungal action on prosopis pods collected just before complete drying, was quick and the seeds were to be exposed through a slit like opening in the leathery endocarp in about 10 days. The seeds thus extracted have necessarily to be sown immediately to obtain good germination since their viability was found to rapidly deteriorate on storage due to the fungal action extending into the seed itself.

The action of fungi on dry pods was found to be very slow due to the absence of sufficient moisture. The pods have to be soaked in water for 3 or 4 days before inoculating with fungal culture and it was observed that the process of extraction was a lengthy one extending over more than 10 days. Germination of the fungus extracted seeds was found to be very erratic and ranged from 10 to 80% depending upon the dryage of the pods, period of soaking, storage etc. and hence no standard technique could be evolved for extracting the seed with the help of the fungus to suit the practical needs. Incidentally various other methods of extraction were investigated to evolve a suitable one for large scale use. Among the various methods tested, viz, pounding, hot water treatment and sulphuric acid treatment, the last one was found to give the best results both as regards extraction and germination. The sulphuric acid treatment is done as follows. The pods are soaked in water for 3 or 4 days and then the leathery pericarp containing the seeds are easily extracted by slightly smashing the soaked pods in a mortor.

The extracted mass of seeds still covered by the pericarp is soaked in 1 : 4 sulphuric acid solution (1 part of sulphuric acid in 4 parts of water) for 24 to 48 hours and then washed with water and kept for drying in shade. After complete drying the fruit coat covering the seed is completely removed by a slight pounding and the seeds can be separated from the fibrous matter by winnowing.

Sulphuric acid treated seeds show a pinkish red colouration due to the removal of the external hard waxy coating due to the action of the acid.

The table below shows the percentage of germination obtained by sulphuric acid treatment:

Treatment	Total No. of seeds sown	Percentage of germination		
		4th day	7th day	15th day
1. 1 : 4 sulphuric acid : water for 24 hours	100	62%	85%	94%
2. 1 . 4 sulphuric acid : water for 48 hours	100	40%	71%	94%

The extraction of seeds by this method was found to be almost cent percent. The final weight of seeds was found to be 18% of the total weight of pods i. e. 3 oz. of seed were obtained from one pound of pods. The above method was found to be the best among the various treatments tried and can be easily adopted for large-scale extractions. Almost cent percent extraction is achieved with a germination percentage of more than 9%

Our grateful thanks are due to Sri M. S. Sivaraman, I. C. S. for his keen interest and encouragement in the studies.

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Gleanings

The use of Rayungans as Seed Material for multiplication of New Sugarcane Varieties: Rayungans are cane seedlings formed by the sprouting of the buds, when the canes standing in the field are topped. This topping of the standing canes in the field is done when the crop is aged about 8 to 10 months. After topping the buds begin to sprout and they become ready for planting after 4 to 6 weeks. Simultaneously after topping, the top portion can be planted in a small portion of the field by planting the stalk vertically so that two buds are completely buried inside the soil. Here also the buds sprout and form seedlings. These are specially called as Tjeblankans. After all the buds have germinated, the cane with the sprouted buds, is cut at the bottom and each sprouted bud is separated from the stalk by leaving about 3″ of the internode at the bottom of the bud and about 1″ above the bud. These separated buds called as Rayungans are now ready for planting. The rayungan is planted in the field in the vertical position by holding the top 1″ of the internode and pressing the same slowly into the soil so as to completely cover the bottom portion of the sprouted bud inside the soil. Care is to be taken that there is no stagnation of water in the field after planting. A small quantity (about a tea spoon) of Ammonium sulphate is to be placed after planting by the side of the rayungan by putting a small hole by its side. The rayungans are to be watched and watered till the rayungans establish themselves. This establishment is difficult in summer months.

About 8000 such rayungans are enough to plant an acre. The rayungans may be planted at a space of 9″ to 12″ row to row.

With a view to test the utility of rayungans as seed material in preference to the normal planting by the use of setts an experiment was conducted at Sugarcane Research Station, Gudiyattam using "Setts" and "Rayungans" as seed material. The setts and rayungans were planted at spacing of 6″, 12″, and 18″ between these two kinds of seed materials. The results indicated that the spacing of 6″ was not good as it affected the yield. The spacings with 12″ and 18″ recorded higher yields.

In general the use of rayungans did not prove superior to setts for getting increased yields. On the other hand its establishment in the field especially during the summer months was found to be very difficult and hence this method of seed material cannot be recomended for wider adoption by ryots, as a source of seed material. However rayungans are found to be useful for rapid multiplication of seed materials.

When a small quantity of seed material is only available or in places where pure and disease free seed materials are to be rapidly multiplied, the rayungans are very useful for such rapid multiplication. A multiplication rate of about 400 times can be achieved by using rayungans in about 8 months time as against ten times by the usual method. —(Director of Agriculture, Madras)

Drilled Fertilizer: Pays in Rice Experiment (Croplife, May 14, 1956, Page 19.) *Sacramento*—Colusa Country rice growers recently told were that fertilizer drilled into the dry rice seed bed before planting makes for increases in production as compared to an undrilled surface application. A report was presented stating that three years of tests carried on at the Biggs Station, Sacramento—California, U. S. A. show nitrogen fertilizer drilled into the seed bed 2 in. deep brought the greatest yield increases, 40%. Drilling the fertilizer 4 in. deep resulted in a 37% increase. Broadcasting the fertilizer on the water brought about the smallest increase of 8%. Broadcasting on the dry seed bed prior to seeding resulted in a 19% increase, and broadcasting on seed bed and digging produced yields 25% higher.
—(G. K. C.)

Coconut Gardens: Improving Soil-Moisture Content: The coconut palm needs a good amount of water for growth and production. Where there is no irrigation available, the crop has to depend entirely on the moisture of the soil. The severe droughty conditions in summer affect the coconut palm very much, especially when it is grown in sandy soils as on the West Coast. It pays, therefore, if the coconut grower adds such materials to the soil as conserve moisture in it. Adding bulky organic manures like farmyard manure, compost and green leaves helps improve sandy soils. Addition of backwater silt, or river or canal silt also helps to retain more moisture. Inter-cultivating the coconut garden not only checks weed-growth, but also results in better moisture conservation in the soil.

—ICAR

Controlling the Rice Bug: Dusting or Spraying Recommended: Rice bugs appear in the paddy field from August to October and suck the sap of the grains which are in milk stage. Ears which are attacked by the bugs do no develop normal grains and become chaffy. For controlling the bugs, dust the crop with five per cent BHC or spray it with 0·25 per cent DDT. This will give you an effective control.

—ICAR

Bottom Mud or Silt: Good for Coconut Gardens: Bottom mud or silt from canals, rivers and backwaters contains a good amount of clay as well as several kinds of plant foods. Spreading silt regularly in coconut gardens prevents soil erosion, increases the capacity of the soil to hold water and raises its fertility. The beneficial effects of spreading silt are more marked in the case of sandy soils.

—ICAR

Coconut Caterpillar: Two Ways of Control: The coconut caterpillar, a serious pest of the coconut palm, can be controlled. Leaves of the attacked palm should be sprayed with 0·2 per cent DDT. One gallon of the spray is sufficient for two palms. The cost of such a treatment works out to less than an anna per palm. As a precautionary measure, the palms in the adjoining areas should also be sprayed with 0·1 per cent DDT. In areas where the rainfall is not heavy, 0·2 per cent BHC may be sprayed instead of DDT. Parasites which feed on the pest also control the pests well. Such parasites are bred at the Coconut Research Station at Kayangulam and also in other States. The parasites are supplied free of cost by the State Governments concerned whenever there is an autbreak of the pests.

—ICAR

Worms in Poultry: One of the common and major causes of financial loss in poultry industry is due to parasitic infestation. The worms harbour in the alimentary canal and lay there thousands of eggs which pass out with the droppings causing pens and fields to become heavily infected. The eggs hatch out into grubs on the grass. Fresh or new stock pick up infection by ingesting those grubs along with grains and feed. They invade several parts of the intestine causing diarrhœa and anæmia. Young birds suffer more than adults, the mortality rate in the former being usually very high. Their growth rate is retarded, susceptibility to bacterial and other diseases increased while the quality, number and size with respect to egg production is adversely affected.

Losses from poultry worms may be reduced or avoided by observing certain simple hygienic precautions :—

1. See that the land is drained well and that no stagnant spots exist.
2. Clean poultry houses frequently.
3. Carry out regular removal of droppings from the land.
4. Treat all susceptible and affected stock.

—(MAN)

Mlk Powder Markets: Australia's production of milk powder has more than doubled since 1945—'46, and the total output of milk powder products in 1955—'56 is expected to exceed 60,000 tons—5,000 tons more than the record output 1954—'55. Perhaps the most interesting feature of the post-war expansion is the marked contrast between the trend of full-cream milk powder production and that of powders derived from milk "by-products" (skim milk, butter-milk and whey). Since 1945—'46 the output of full-cream milk powders has shown a net increase of about 30% (from 23,400 tons to about 30,000 tons), which is approximately the same proportion as the next expansion in the total dairying production. Over the same period, however, the output of "by-product" powders increased nearly tenfold, from 3,700 tons to an estimated 33,000 tons.

Since 1945—'46, Australia's milk powder exports have risen from 5,700 tons to an estimated 35,000 tons this season. Shipments of full-cream powders have increased, but fluctuated widely from year to year, and followed variations in production fairly closely. On the other hand, exports of skim milk powder have shown a consistently upward trend, significantly exceeding the volume of full-cream milk powders in each of the last three seasons. The post-war development of the milk powder industry in Australia has been primarily associated with the expanding export market, especially for skim milk powder.

— (ANN)

Atomic Energy on the Farm: The use of atomic energy to develop the rural areas of Australia is strongly advocated by a nuclear scientist, Professor Harry Messel, Professor of Physics at Sydney University. If there is one country that could be opened up with small nuclear power package plants, that country is Australia, says Professor Messel.

"Imagine having hundreds of package power reactors generating from 2,000 to 10,000 kilowatts throughout Australia, through the outback of New South Wales, throughout the Northern Territory. Imagine nuclear power plants converting saline water into pure water and pumping it for irrigation purposes. Imagine this, and more, and you will see what nuclear energy can do for this great country of ours. This is not a dream-every bit of it will some day become a reality". Professor Messel believes that the possibilities of raidio-activity for food preservation are immense and exciting, as many meats and other foodstuffs now appear capable of being stored for a very long period of time after being radiated.

— (ANN)

Weather Review — For September, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	7·8	+ 3·1	27·9	South	Madurai	5·0	+ 0·3	17·4
	Tirurkuppam*	7.9	+ 1·8	26·4		Pamban	0·1	— 1·0	2·3
	Vellore	6.7	— 0·2	27·3		Koilpatti*	2·3	+ 0·8	11·0
	Gudiyatham*	7.7	+ 4·1	22·7		Palayamcottai	0.4	— 0·8	6·9
East Coast	Palur*	8·1	+ 2·8	26·8		Ambasamudram*	Nil	— 1·4	7·5
	Tindivanam*	6·8	+ 2·2	24·8	West Coast	Trivandrum*	2·5	— 2·0	35·8
	Cuddalore	6·2	+ 1·0	20·7		Fort Cochin	9·4	+ 1·7	101·9
	Nagapattinam	8·7	+ 5·4	19·2		Pattambi*	4·7	— 2·9	71·9
	Aduthurai*	13.7	+10·6	24·7		Kozhikode	6·9	+ 0·3	104·9
	Pattukottai*	9.7	+ 6·7	21·6		Taliparamba*	8·1	— 3·1	122·5
Central	Salem	8·3	+ 2·2	22·1		Wynaad*	4·4	— 2·5	65·0
	Coimbatore (A. M. O.)*	0·2	— 1·0	9·3		Nileshwar*	7·3	— 6·9	132·7
	Coimbatore	0·1	— 1·5	9·2		Pilicode*	6·1	— 6·3	107·3
	Tiruchirapalli	9·7	+ 5·7	15·6		Mangalore	6·7	— 2·7	130·1
						Kankanady*	6·5	— 6·5	132·9
						Kotekar*	7·8	— 4·9	@
					Hills	Kodaikanal	4·9	— 2·4	30·1
						Coonoor*	3·5	— 0·4	18·9
						Ootacamund*	2·3	— 2·3	23·5
						Nanjanad*	4·7	— 0·9	32·2

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.

2. @ = It is a new station. The raingauge was installed in March 1956.

The month began with widespread rains in Malabar and South Kanara, and localised showers in Tamilnad and Travancore-Cochin. The monsoon gained strength in the South Bay on 2—9—1956 and extended over the Central Bay of Bengal on the next day. Till 6—9—1956 monsoon was fairly active in the West Coast with a few scattered and localised showers in Tamilnad. For two days from 7—9—1956 conditions remained unchanged in the West Coast while the weather was mainly dry in Tamilnad. On 9—9—1956 and in the subsequent two days also the monsoon was fairly active in the West Coast while showers were scattered in portions of Tamilnad. On 12—9—1956 showers became localised practically in the entire region. An Easterely wave was found approaching coastal Tamilnad on 13—9—1956 and this gave localised showers in South Tamilnad when the weather was dry elsewhere. For four days from 14—9—1956 localised showers were received in Tamilnad while the West Coast experience a dry weather. On 18—9—1956 showers were localised in Tamilnad and Malabar and South Kanara when Travancore-Cochin had dry weather. Thundershowers were scattered in Travancore-Cochin and Tamilnad when Malabar and South Kanara had dry weather on 19—9—1956. The monsoon was found strengthening over the South Bay on 20—9—56.

Showers where localised in Travancore-Cochin and at a few places elsewhere in the region on 20—9—1956. On 21—9—1956 showers were fairly widespread in Travancore-Cochin and localised in Tamilnad while the weather was dry in Malabar and South Kanara. On 22—9—1956 west - coast had fairly widespread rains while the North Tamilnad had only localised showers. The monsoon gained strength over the Peninsula on 23—9—1956 with widespread rains in Travancore-Cochin and scattered showers elsewhere. For two days from 24—9—1956 the West Coast had fairly good rains while Tamilnad had dry weather. On 26—9—1956 and in the subsequent two days rains were fairly widespread in the West Coast while they were highly localised in Tamilnad. Rains were fairly widespread in North Tamilnad and localised elsewhere on 29—9—1956. The month ended with fairly widespread rains in Travancore-Cochin and localised showers elsewhere in the region.

Considering the month as a whole, rains in September, 1956 were fairly above normal in Tamilnad except in the districts of Coimbatore and Ramanathapuram and to some extent in Tirunelveli also. In the West Coast and hills they were somewhat sub-normal.

The noteworthy rainfall and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
1/9/56	Madras (Meenambakkam)	4·0	North	7·5	+ 2·2	Above normal
16/9/56	Tiruchirapalli	3·0	East Coast	8·9	+ 4·8	do
17/9/56	Madras (Nungambakkam)	4·0	Central	4·6	+ 1·4	do
18/9/56 & 29/9/56	Kallakurichi (Each day)	3·0	South	1·6	— 0·4	Below normal
			West Coast	6·4	— 3·3	do
30/9/56	Mathurai	3·0	Hills	3·9	— 1·5	do

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 11—10—1956

C. B. M. & M. V. J.

Departmental Notification

Gazetted Officers — Postings and Transfers.

Name and present post	Posted as
Albuquerque, S. D. S., Supdt., A. R. S., Nileswar.	Supdt., Cashew Res. Station, Mangalore.
Fuzlulakhan, Supdt., Ambalavayal.	Assistant, Fruit Specialist, Coonoor.
Gopalan Nair, T., Banana Res. Officer, Aduthurai.	Supdt., A. R. S., Ambalavayal.
Kuppamuthu, K., Assistant Lec. in Agriculture, Coimbatore.	Principal, Basic Agr., Training School, Coimbatore.
Krishnan, R. H., Assistant in Paddy, Pattukottai.	S. D. O., Vellore.
Kuppuswamy, B. S., Assistant Fruit Specialist, Coimbatore.	Assistant Fruit Specialist, Coonoor.
Kalyana Sundaram, D. A. O. on leave.	D. A. O. Crop Sampling, Tanjore.
Madhava Rao, V. N., Supdt., Cashew Research, Mangalore.	Assistant Fruit Specialist, Coimbatore.
Subramaniam, T. V., Assistant Mycologist, Coimbatore.	P. P. O. Mycology, Coimbatore.
Sriraman, K., D. A. O. on leave.	Secretary, Coimbatore Market Committee, Tirupur.
Srinivasan, V., Supdt., A. R. S. Aduthurai,	Deputed to Ceylon to study the method of Tobacco Cultivation.
Sahadevan, P. C., Assistant Paddy Specialist, Coimbatore.	Assistant Paddy Specialist, Pattambi.
Samuel Sundararaj, Assistant Fruit Specialist, Coonoor.	Banana Research Officer, Aduthurai.
Uthaman, P., Assistant Paddy Specialist, Pattambi.	Supdt., A. R. S. Nileshwar.

Upper Lower Subordinates — Postings and Transfers

Name and present post	Posted as
Ananthakrishna Rao, P. N., Working in the I. C. A. R. Scheme, Mangalore.	Assistant in Paddy, Mangalore.
Anandam Pillai, S., A. D., Dindigal.	Marketing Assistant, Tiruchirapalli.
Ambikacharan, K., A. D., Madras.	Marketing Assistant to State Marketing Officer, Madras.

Name and present post	Posted as
Bhadrachalam, R. N., Kolathan.	A. D., Tiruvannamalai.
Chandrasekharan, P., Vallioor.	Cotton Assistant, Koilpatty.
Ganghadaran, T., Malabar.	Assistant in Botany, Coimbatore.
Mahimaidass, Marketing Assistant, Trichirapally.	Assistant Lec. in Agrl. Economics, Coimbatore.
Narayanaswamy, K. R., P. A. to D. A. O., Guindy.	Marketing Assistant to State Marketing Officer, Madras.
Narayana Raja, P., Kunnathur.	Assistant in Fruits, Aduthurai.
Perumal, A. S., Special Marketing Asst. Pudukottai.	Extension Officer for Agrl., Perambalur.
Pattathan, B. N., Extension Officer, Nileshwar.	P. A. to D. A. O., Coimbatore.
Rajendran, N., Kanjeepuram.	A. D., Cheyur.
Ramanathan, M. K., Ayyampet.	P. P. A., Tanjore.
Raghu Shetty, K., F. M. Central Farm, Coimbatore,	Cashew Assistant, Mangalore.
Sankarankutty, M. M., Malayalam Journal Assistant,	A. D. Vegetables, Madras.
Subramaniam, A., Vembangudi.	Paddy Assistant, Aduthurai,
Syed Fuzulukhan, Tirupathur.	A. D., Sithalai.
Srinivasan, G., Karaikal.	A. D., Tiruvarur.
Kumari Savithri, V., Assistant in Entomology, Coimbatore.	Assistant in Chemistry, Coimbatore.
Soloman Durairaj, Botany Assistant, Gudiattam,	Botany Assistant, Coimbatore.
Shivarama Rai, P., Cashew Res. Assistant, Mangalore.	F. M. Central Farm, Coimbatore.
Sankaranarayanan, C. S., P. A. to D. A. O., Coimbatore.	Teaching Assistant in Agrl. Economics, Coimbatore.
Umapathy, M. S., Vellore.	Cane Assistant, Palur.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE
DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

CROPS
COTTON, GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Condition of Commercial Crops in the Areas of Market Committees for the Month of August, 1956

Cotton: (In this Section: Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks: Tirupur: Lint: The market opened with a stock of 7847 candies of Cambodia lint and 1716 candies of Karunganni lint, 6516 candies of Cambodia and 262 candies of Karunganni were received including 1401 candies of Cambodia and 54 candies of Karunganni lint produced from ginneries. Despatches accounted for 7501 candies of Cambodia and 424 candies of Karunganni lint which include 955 candies lint sent to Travancore Cochin State, North Arcot, Tiruchirapalli, Orissa, Bombay, Madurai, Calcutta, Mysore, Madras and Nilgiris. The month closed with a stock of 6862 candies of Cambodia and 1554 candies of Karunganni lint.

Kapas: The kapas market started with an opening stock of 16,154 pothies of Cambodia and 621 pothies of Karunganni kapas. Arrivals amounted to 15,096 pothies of Cambodia and 414 pothies of Karunganni kapas into this market, which include 5,130 pothies kapas received from Salem, Madurai, Villupuram, Tiruchirapalli and Tanjore. 19,017 pothies Cambodia and 627 pothies of Karunganni kapas were disposed off leaving a closing stock of 12,593 pothies of Cambodia and 408 pothies of Karunganni kapas.

Koilpatti: Lint: The lint market opened with an opening stock of 148 candies of Karunganni lint. Arrivals amounted to 375 candies of lint from the surrounding areas. 450 candies of Karunganni lint were disposed, leaving a closing stock of 73 candies of lint.

Kapas: The kapas market opened with a stock 600 pothies, 400 pothies were received and 1,000 pothies were disposed of. There was no stock at the end of the month.

Ramanathapuram: Lint: The market opened with a stock of 1,165 candies. Arrivals amounted to 3220 candies of lint. Disposals amounted to 3020 candies, leaving a closing balance of 1,365 candies of lint.

Kapas: The kapas market started with a stock of 17,000 pothies, 36,350 pothies were received into the three markets of Virudunagar, Rajapalayam and Sattur. Disposals amounted to 36,100 pothies leaving a closing balance of 1,950 pothies.

South Arcot: Kapas: The market started with a stock of 63 pothies during the month. 138 pothies were received into Villupuram market. 192 pothies were despatched to Tirupur leaving a closing stock of 9 pothies in the market.

Prices: Tirupur: Lint: The market was active with good turnover and the prices were steady.

Kapas: The prices were steady with good turnover.

Koilpatti: Lint: After opening at Rs. 840 to 860 the prices gradually increased to Rs. 880 to 900 in the middle of the month. The prices continued steady but mills did not purchase stocks in view of the high prices.

Kapas: The prices of kapas remained steady at Rs. 120 to Rs. 126 for Uganda Kapas.

Ramanathapuram: Lint: The prices in the three markets firmed up slightly due to good demand and shrinking stocks. The prices of lint were as follows:

		Opening Rates	*Closing Rates*
		Rate per candy	
Karunganni	...	Rs. 830 to 864	Rs. 874 to 880
Tinny Karunganni	...	Rs. 815 to 824	Rs. 833 to 845
Tinny	...	Rs. 751 to 815	......
Uganda Certified	...	Rs. 970 to 991	Rs. 1,006

Kapas: The prices slightly increased due to good demand and moderate arrivals. The prices were as follows:

		Opening Rates	*Closing Rates*
		Rate per pothi	
Karunganni	...	Rs. 106 to 110	Rs. 112½ to 117½
Tinny Karunganni	...	Rs. 88 to 103	Rs. 93 to 108
Tinny	...	Rs. 66 to 84	Rs. 75 to 90
Uganda-Rajapalayam	...	Rs. 114 to 135	Rs. 125 to 139

South Arcot: Kapas: Arrivals were meagre and the prices were put up to Rs. 104—6—0 (average).

Groundnuts: (In this Section: Candy=531 lb.
Bag= 80 lb.)

South Arcot: Stocks: All the markets of South Arcot District together started with a stock of 2,034 tons. Arrivals totalled 10,250 tons in all the markets of South Arcot District. 383 tons were received from other districts like Tiruchirapalli, Salem and North Arcot. 7,209 tons were crushed by power mills and 225 tons were crushed by Chekkus 2723 tons were despatched to Tanjore, Tiruchirapalli, Salem and Madras while 186 tons were exported to Pondicherri State. Wastage amounted to 443 tons. There was a closing stock of 2,891 tons at the end to the month.

Prices: The prices were on the increase in the first fortnight and gradually declined at the end of the month due to rainy weather.

North Arcot: Stocks: The market started with a stock of 1,159 tons of pods and 596 tons of kernels. Arrivals amounted to 41 tons of pods and 589 tons of kernel. Offtake amounted to 382 tons of pods and 435 tons of kernel, leaving a closing stock of 818 tons of pods and 750 tons of kernels. The market was dull due to poor arrivals and absence of buying interests.

Prices: During the month the prices of groundnuts rose with good demand for groundnut oil from Bombay and Calcutta. The prices were ranging between Rs. 170 to Rs. 175 per candy as against Rs. 101 to Rs. 107 previously.

Ramanathapuram: Stocks: The market started with a stock of 1,300 tons of groundnut kernels. Arrivals amounted to 3,900 tons, 4,700 tons of groundnut kernels were disposed off, leaving a closing stock of 500 tons of groundnut kernels.

Prices: The opening and closing prices of groundnut kernels are as follows:

		Opening Rate	*Closing Rate*
Groundnut Kernels	...	Rs. 160 to 171	Rs. 160 to 162

Gingelly: In this Section: Bag=168 lb.)

South Arcot District: Stocks: Gingelly arrivals were on the increase in the first week and third week and decreased in the second last week.

Prices: The prices were steady during the month.

Coconut and its products: (In this Section: Candy = 700 lbs.)

Coconuts: Stocks: The arrivals were fair and the transactions of coconuts in Malabar and South Kanara were as follows:

(In thousand)

Centres	Opening Stock	Arrivals	Despatches	Closing Stock
Malabar District:				
Kozhikode ...	7497	3100	4400	7109
Badagara ...	604	3100	2812	892
Ponnani ...	300	560	530	330
Tellicherry & Dharmadam ...	517	945	963	499
South Kanara:				
Mangalore ...	55	175	170	60

Prices: The prices of Coconuts were as follows per 1000 nuts.

	Maximum	Minimum
Malabar District:		
Kozhikode ...	Rs. 110	Rs. 90
Ponnani ...	,, 1,258	,, 115
Badagara ...	,, 139	,, 90
Tellichery & Dharmadam ...	,, 928	,, 92
South Kanara:		
Mangalore Dry ...	,, 180	,, 135
,, Raw ...	,, 140	,, 115

Copra: Stocks: The arrivals of copra were poor due to rainy weather conditions. The transactions of copra in Malabar and South Kanara were as follows:

Markets	Opening Stock	Arrivals	Disposals	Closing Stock
Malabar district: (In candys)				
Kozhikode ...	4923	4800	5600	4123
Badagara ...	805	2480	2290	996
South Kanara district:				
Mangalore (In tons)...	117	440	450	107

Prices: The prices of Copra District were as follows:

(Prices per candy)

Variety		*Kozhikode* Minimum	*Kozhikode* Maximum	*Badagara* Minimum	*Badagara* Maximum
Office	...	Rs. 295	Rs. 290	Rs. 315	Rs. 297/8
Edible	...	,, 310	,, 300	...	...
Madras	...	,, 305	,, 300	,, 325	,, 320
Raypur	...	,, 332	,, 325	,, 350	,, 320

The prices of Copra in Mangalore Market ranged at Rs. 290 to 310.

Arecanuts: (In this Section: Bag=100 lbs.)

Stocks: The arrivals of arecanuts were on the increase steadily. The transactions of arecanuts in Malabar and South Kanara were as follows:

	Opening Stock	Arrivals	Disposals	Closing Stock
Malabar district:				
Kozhikode (100 lb.)	290	2745	2219	816
South Kanara district:				
Mangalore (in cwts.)	8312	5800	8700	5412

Prices: The prices increased due to good demand. The prices of arecanuts were as follows:

	Maximnm	Minimum
Malabar District:		
Kozhikode	Rs. 205	Rs. 200
South Kanara District: (Per Cwt.)		
Koka ...	,, 130	,, 85
Choll	,, 195	,, 160
Malabar Supari	No Stock	
Mangalore Supari	175	145

Tobacco: (In this Section: Candy=500 lbs.)

Coimbatore: Stocks: The market opened with a stock of 23,340 candies of chewing and 2200 candies of Cheroot varieties. About 25 candies of chewing tobacco from Madurai and 20 candies of beedi tobacco were reported to have arrived. 3,715 candies chewing and 700 candies of cheroot varieties were despatched to Palghat, Pattukottai, Karaikudi, Aleppy, Tiruchur, Ernakulam, Dindigul, Tanjore, Malabar, and Chengleput.

Prices: The prices of different varieties of tobacco in Tirupur were as follows:

(Prices in Rs. per candy of 500 lb.)

Variety		I Grade	II Grade	III Grade
1. *Chewing Tobacco (Sun-cured):*				
(a) Meenampalayam	...	350—450	250—325	175—220
(b) Other varieties	...	235—295	170—210	85—120
2. *Cheroot varieties:*				
Sun-cured (grown in Erode and Bhavani)	...	275—335	200—275	120—155
3. *Chewing varieties:*				
Pit-cured (grown in Palladam and Sulur areas)	...	250—350	175—250	100—150

Review of the Administrative Activities of the Market Committees for August, 1956.

General: All the Market Committees continued to function under Section 6-A of the Madras Commercial Crops Markets Act except Coimbatore Market Committee and Malabar Market Committee which are functioning under an elected body. The stalemate caused in the Market Committees of Tirunelveli Market Committee and Ramanathapuram Market Committee has not yet been cleared awaiting the judgment of the Supreme Court.

The following is the progress made in the issue of licence by the Market Committees in the State.

	Section 5 (1)		Section 5 (3)		Weighmen	
	A	B	A	B	A	B
North Arcot Market Committee	177	1059	63	641	35	385
South Arcot Market Committee	218	1393	180	1208	159	1113
Coimbatore Market Committee	59	794	75	843	30	573
Tirunelveli Market Committee	—	13	—	16	—	7
Ramanathapuram Market Committee	—	29	—	28	—	7
Malabar Market Committee	49	363	65	1393	38	318
South Kanara Market Committee	10	146	—	62	1	57

A: During the month. B: Upto the end of the month from January, 1956.

Meetings: A meeting of the newly elected committee of the Malabar Market Committee was convened by the Collector of the district on 1—8—1956 when Sri. P. B. Kurup and Sri. A. G. Kunhi Krishnan Nair were elected as Chairman and Vice-Chairman respectively.

Quality appraisal: The South Arcot Market Committee continued its work on the analysis of Groundnut Kernels marketed in the district. During the month 118 samples were drawn and analysed in 5 markets out of arrivals of 97,413 bags of Groundnut Kernels comprised in 28,031 lots. The total common refraction was below 4% in 96 samples and 5 to 8% in 22 samples. The Groundnut crops marketed at Cuddalore and Panruti were wet and that the crop marketed at Virudachalam contained moisture at its minimum. Eighty per cent of the crop marketed in all the markets contained total refraction below 4% and the rest between 5 to 8%.

Quality Competition: Fifty four entries were secured by the South Arcot Market Committee for summer Groundnut crop quality competition during the month bringing the total to 160.

South Arcot Market Committee, Cuddalore

Regulated Markets Service Week Celebration

The Regulated Markets Service Week, the first of its kind was celebrated at Villupuram from 10—9—1956 to 15—9—1956. A large gathering of representatives of growers and traders were present. The Service Week was inaugurated by Sri Henry Peter, Collector of South Arcot on the tenth at the Villupuram Regulated Market premises. Sri K. V. Natesan, Secretary of the South Arcot Market Committee welcomed the gathering and explained the object of the Service Week. Sri R. V. Sundara Reddiar, Advocate, Cuddalore spoke on "Agricultural Marketing". The usefulness of Regulated Markets, the popularity that they enjoy among the public and the important role that they play in the economic uplift of the rural masses were the salient points on which the speaker laid stress. The need to expand the activities of Regulated Markets to other agricultural crops was also emphasised by him. Incidentally he requested the Collector to extend all possible help in the establishment of a sugar factory in Villupuram Taluk. The Collector thereafter opened an Exhibition got up by the Committee. The exhibits of the Agricultural Department as also of the Market Committee and that of the Hindusthan Vanaspathi, Tiruchirapalli were on display.

On the second day, Sri R. Venkatasubba Reddiar, B. A., B. L., of Tindivanam spoke as to how best the Co-operatives and Regulated Markets can co-ordinate their activities in the betterment of marketing. He envisaged the establishment of marketing societies in all assembling centres to advice and advance loans to the producers on the pledge of produce and expansion of Regulated Markets for other crop also.

Sri Sitharaman, Sub Registrar of Co-operative Societies, Cuddalore was the speaker on the third day. Sri S. Rangaswami Nadar presided. The speaker laid stress on the establishment of Marketing Societies along with the Regulated Markets to improve the facilities in the sphere of "perfect marketing" that is aimed at. The work of Marketing according to the speaker will be complete and beneficial to the public only when the Regulated Markets worked in co-ordination with the Co-operatives in the assembling centres. Sri M. Shanmugha Udayar, the speaker of the fourth day traced the history and the growth of the South Arcot Market Committee in South Arcot. He had nothing but praise for the working of Regulated Markets in South Arcot and visualised the introduction of other important agricultural crops under the fold of the Madras Commercial Crops Markets Act. Sri V. R. Nagarajan, B. A., B. L., M. L. A. presided.

The fifth days programme was highlighted by an erudite lecture on the Madras Commercial Crops Markets Act and Rules and the advantages of Markets established under the Act by Sri M. Obaidullah Shah, State Marketing Officer, Madras. Sri S. K. Sambandam, Member, South Arcot Market Committee presided. The speaker traced the history of Regulated Market legislation and how the Royal Commission on Agriculture recommended the enactment of the Commercial Crops Markets Act. The various provisions of the Act were discussed in detail and the working explained to the audience. The speaker also announced that marketing facilities will be afforded to the public during the second five year plan period, when werehouses and regulated markets will be established in areas which are not now covered either by Market Committees or Co-operatives.

On the last day of the Service Week Sri S. Chidambara Iyer, Ex-M. L. A. presided. In his presidential address he referred to his association with the South Arcot Market Committee in its initial stages and was glad to learn that 90% to 95% of the marketable surplus is now sold through the Regulated Markets of this Committee. Restriction of buying and selling inside the Regulated Markets, he added, will be welcomed by the producers and traders. Thereafter Sri R. M. Sundaram, I. C. S., Director of Agriculture distributed the prizes to the winners of the quality competition conducted by the South Arcot Market Committee and the yield competition conducted by the Agricultural Department. Being a native of South Arcot district he said he was exceptionally happy that the South Arcot Market Committee is doing yeomen service to the

producers of the district through the regulated markets. Incidentally he advocated that Co-operative Societies can work at the village level and thereby enjoy the facilities offered by the Government in advancing loans through the Co-operative Department. He also referred to the system of Co-operatives in China where the co-operatives have advanced to such a stage that one person is every family is an active member of the co-operative institution. The proceedings of the day concluded with the singing of the National Anthem.

Crop and Trade Reports

Cotton — First Forecast Report — 1956 — '57 — Madras State: The area sown with cotton in the Madras State upto 25th July 1956 is estimated at 74,800 acres. Compared with the area of 74,500 acres estimated for the corresponding period of previous year and an average area of 64,200 acres calculated for the five years ending with 1955 — '56, this is an increase of 0·4 percent and 16.5 percent respectively. The area estimated is the same as that of last year in the districts of North Arcot, Malabar and South Kanara. A decrease in area is estimated in the districts of South Arcot, Coimbatore, Tiruchirapalli and Tanjore and an increase in the other districts of the State except the Nilgiris where the area under the crop is little or negligible.

The estimated area by varieties in the current year together with the corresponding figures for the previous year is given below:

Variety		Area in '00' acres	
		1956 — '57	1955 — '56
(1)		(2)	(3)
Madras American - Cambodia	..	260	203
Madras American Cambodia - Uganda	..	110	150
Total	..	370	353
Karungannies	..	255	245
Karunganni - Ordinary	..	59	81
Uppam including Ndam & Bourban	..	64	66
Total	..	378	392
GRAND TOTAL	..	748	745

Ginger — First report — 1956 — '57 — Madras State: The area under ginger crop upto 25—8—1956 in the districts of Madurai, Malabar, South Kanara and the Nilgiris is estimated at 13,700 acres compared with the area of 13,030 acres for the corresponding period of the previous year it shows an increase of 5.1 percent. An increase in area is estimated in the districts of Malabar, South Kanara and the Nilgiris and a decrease in the district of Madurai. The condition of the crop is satisfactory except in the Nilgiris district where the crop is stated to have been affected by shoot borer of Ginger and soft rot.

Pepper — First Forecast Report — 1956 - '57 — Madras State: The area under pepper upto 25—8—56 in the districts of Malabar, South Kanara and the Nilgiris is estimated at 123,650 acres (105,100 acres in Malabar, 18,500 acres in South Kanara and 150 acres Nilgiris districts) as against 120,000 acres (120,360 acres in Malabar, 17,490 acres in South Kanara and 150 acres in the Nilgiris districts). estimated for the corresponding period of the last year. The condition of the crop is reported to be satisfactory except in South Kanara district where the yield is expected to be below normal.

Groundnut — First Report — 1956 - '57 — Madras State: The area sown with the groundnut crop in the Madras State upto July 1956 is estimated at 216,500 acres. Compared with the area of 205,700 acres for the corresponding period of the previous year, the present estimate is an increase of 5·3 percent. Compared with the average area of 189,000 acres calculated for the five years ended 1955 - '56, the current years estimate is an increase of 14·6 percent. The area in Ramanathapuram district estimated this year is the same as that for the previous year. An increase in area is estimated in all the other districts except Tiruchirapalli and Madurai where a decrease is estimated. The yield per acre is expected to be normal in Coimbatore district and slightly below the normal in the other districts. The total yield is estimated at 126,100 tons of unshelled nuts as against 117,100 tons estimated for the corresponding period of the previous year representing an increase of 7·7 percent. Compared with the average yield of 98,400 tons calculated for the five years ended 1955 - '56, the current year's estimate shows an increase of 28·2 percent.

Cotton — Intermediate Condition Report — Period upto the end of August, 1956 — Madras State: The main season for sowing of cotton is not yet over in parts of the State. Sowing of the crop was in progress in the districts of Salem, Coimbatore, and Tirunelveli. The condition of the early sown crop is reported to be below normal in the district of South Arcot for want of adequate rains. The crop was affected by pest in the districts of Coimbatore and Tirunelveli. It is too early to report on the condition of the crop in the districts of Salem, Tanjore and Ramanathapuram.

Sugarcane — Intermediate condition report — Madras State — Period upto the end of August 1956: The condition of the sugarcane crop is reported to be normal in Salem and South Kanara districts above normal in the districts of South Arcot and North Arcot. It is too early to report on the condition of the crop in Tanjore, Ramanathapuram and Tirunelveli districts.

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Editorial

The Planning Commission has now revised the targets for agricultural production for the Second Five Year Plan period at an overall increase of 28 per cent as against an earlier figure of 40 per cent. Production of food grains is to be stepped up by 25 per cent and commercial crops by 34 per cent. It is vital that these targets are achieved to make for the existing shortages, to meet the needs of a growing population with increasing purchasing power and also to provide a small surplus for export. The Planning Commission is of the view that 'only a programme aimed at doubling agricultural production in the course of the next ten years or thereabouts could meet the requirements of the national economy, bring about a substantial rise in agricultural incomes and reduce the gap between these and non-agricultural incomes'.

The attainment of these targets would involve putting in the maximum effort by all concerned. Broadly, the increase in production is to be brought about by adopting sound farming techniques like the use of high yielding strains, by fuller utilisation of manurial resources including fertilisers, irrigation, soil conservation and adoption of modern plant protection methods; these are expected to yield the greatest possible benefits in the shortest possible time. In short, the main feature of the plan is to increase production in every crop without much increase in the crop areas themselves.

In any discussion of maximising crop production, manures and fertilisers occupy the pride of place as contributing to the highest yield increases. Judicious manuring can, in many cases even double the yields, especially over vast tracts of marginal lands, where no manure is used for many centuries. When better irrigational facilities and

improved seeds are provided an increased demand would arise for plant nutrients from the soil. The fertiliser industry is making great progress during the last ten years, as also the pace of fertiliser consumption, specially in Madras. Even so, recent international developments have been disquieting and dependance on foreign supplies of plant nutrients particularly of phosphorus, may become hazardous. It is gathered that there is already a squeeze for superphosphate, as all imports into our country are from North African ports. This is a warning to us that we should not neglect to utilise our indigenous phosphate resources.

When chemical fertilisers are available in plenty, the farmer is apt to be complacent about native organic manure sources. Cattle manure has been the backbone of Indian Agriculture from time immemorial. It is imperative that the farmer is constantly reminded of the need to actively conserve this source. It must be brought home to him that chemical fertilisers yield good results only when they are used along with organics like cattle manure or green manure. Recent concepts of the importance of chelating agents have led to a reassessment of the significance of organic matter in affecting nutrient availability. Chelating agents derived from the breakdown of organic matter as a result of microbial activity chelate iron, aluminum and calcium, thereby reducing phosphate fixation. Further they play a useful role in improving trace element availabilities; that of iron, manganese etc. Organic matter, thus, has an added role in a manuring programme.

It needs no argument to convince anyone that the future well-being of India's millions is vitally linked up with the attainment of all the targets of the Second Five Year Plan; and given a well-balanced and co-ordinated effort, utilising all the technological potentialities towards increasing agricultural production, we can look forward with confidence to its successful achievement.

Agricultural Science and Technique in New China*

China is a country of vast territories and bountiful products. She has a long history in agriculture. The Chinese peasants have accumulated a very rich experience and cultured many good quality varieties over the centuries. These precious bequests had not been well studied but under the leadership of the Central People's Government, the Chinese people have accomplished land reforms, rehabilitated and developed agricultural production and started the agricultural co-operative movement, all of which have created a favourable condition for the further development of the Chinese agriculture.

At the time of the founding of the People's Republic of China, the Central People's Government explicitly proposed the principle that agricultural science and technique must serve the development of agricultural production by increasing the yield of unit area, and that the creation and dissemination of scientific knowledge shall be encouraged and rewarded. Because of Governmental efforts agricultural science has been and is being advanced rapidly. By the end of the year 1955, we have established seven regional agricultural science research institutes, five specialised research institutes, 153 provincial agricultural research institutes and experimental stations, 7,997 extension centres of agriculture technique, 1,500 veterinary and animal husbandry stations and 782 artificial insemination centres. There are 29 agricultural Universities and Colleges with 1,550 professors, associate and assistant professors, and 16,698 undergraduate students; 94 secondary agricultural technique schools with 3,447 teachers and 44,708 students. The number of students graduated from these Universities and Colleges within the past five years was 16,900 which is 13,189 more than the students graduated during the period of over 20 years under the old regime. Under the leadership of the people's Government, agricultural scientific workers study the advanced agricultural scientific theories and techniques of the Soviet Union and other nations, going down to the villages to summarise the peasants' producing experience, studying the methods of increasing production for various crops in different areas in order to solve the main problems now existing in agricultural production. As a result, they have enlarged the function of agricultural science in ensuring the increase of agricultural production.

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* Speech delivered by His Excellency Chiang Chi Hsien, Vice-Minister and Leader of the Agricultural Scientific Study Mission of the Peoples Republic of China on the occasion of the reception held in honour of the Mission at the Agricultural College and Research Institute, Coimbatore, on 3rd November 1956.

The work of our agricultural scientists and technicians is carried out in the following ways:

Improvement of varieties of crops: In accordance with the advanced theories on genetics, selection, propagation and breeding of good quality seeds and taking into consideration the main crops in China our institutions of agricultural research have carried out the work for improvement of varieties. At the same time, a campaign of selecting seed has been widely developed among the masses of the peoples in order to produce the good quality seeds from peasant households by all possible effort. Upto 1954, there were 1,300 good quality varieties which have so far been discovered, selected and bred out. The good quality grains have been planted on an area of 300 million mou of land (20 million hectares), the area of cotton fields planted to good quality seeds has reached more than 50 million mou of land (3·6 million hectares). For instance, both the 'Pi Ma No. 1' wheat, bred out by the Northwest Agricultural College in Wu Kaun County, Shensi Province and the good quality spring wheat No. 96%' selected by Kansu Province have the features of high yield and rust resistance, and generally their production is 20 to 30 percent more than the local varieties. The 'Pi Ma No. 1' alone has been planted on an area of more than 7 million mou of land in Shensi province. The good quality paddy rice, Sun Li Sian and Van Li Sian, selected by the Hunan Experimental Farm of paddy rice have the characteristics of high output, good quality, and highrate of milling rice, and these have been planted on an area of our 13 million mou of land (860000 hectares) in provinces of Hunan, Hupeh, Szechwan and Anwei. With a view to meet the needs of double and treble crop areas in China, the Naking Agricultural College has bred out a good quality wheat 'Nan Da 2419' which is suitable to be sown late in the double crop areas (one paddy rice and one wheat). The Kiangsi Agricultural Experimental Farm has selected an early rice 'Nan Te' which possesses the characteristics of early ripening, bumper harvest and suitable to double crop areas.

In the field of culture and breeding of good quality cotton, the Gin Wei Farm in Shensi province has selected out 'Gin Sze' and 'No. 517'. In both of them the period of maturity is advanced by five days and the output raised 10 percent. As to the miscellaneous careals, by using the method of interspecific cross breeding the Feng Tze Farm in shantung province has bred out the good quality maize variety, 'Feng Taz No, 2', 'Feng Taz No. 4' and 'Ge Yu No. 25'. Their output is 30 percent to 100 percent higher than those of the

local varieties. The multi-blade tobacco selected by Ke Yuan Farm in Yuan Province has 150 leaf blades as the highest and the yield is twice as much as that of the local tobacco. There are also many model seed selectors coming out from the masses. For example Yu Chin Shou and his wife of Shangtung Province have selected out a 'Bean Swe' (flat head) wheat and a Japonic type late variety rice 'Lau Lei Chin' is selected by Chen Young Kang, Kiangsu Province. These two varieties have the features of bumper harvest, good quality, as well as higher resistance to adverse conditions.

Improving the method of cultivation: To meet the demand of the organized peasants for improving the technique of cultivation, the method of summarizing experience of the masses in connection with popularization of the advanced science and technique has been adopted. The masses of the people are mobilized to develop a patriotic emulation campaign for increased production and orgainzed to contrast and demonstrate among themselves those with higher yield and better farming methods. The experiences which have proved effective in increasing production through practice are actively given publicity and popularized.

According to a typical survey, other conditions being equal, by employing improved plough the output is remarkably increased over that by using old-type plough. The quality of cultivation done by two-wheel and two-blade plough is even better and the output can be increased about 15 percent than by the old-type plough. Up to 1954, the number of various types of improved ploughs sold to the peasants has reached over 500,000 pieces. Some peasants often overcome the limitation imposed by the old type farm implements by deepening the furrow and extra ploughing. Some peasants plough the land deeply every three or four years. As a result, the deep-ploughed area is expanded year after year. In the dry farming area of North China, to prevent drought and retain moisture in the soil, the experiences of early and deep ploughing, harrowing side by side with ploughing and raking in the early spring have been popularized. In south China, the method of deep ploughing, culture of vigorous and healthy seedlings, transplanting and irrigation in time and intercultivating have been extended. In areas where the temperature and rainfall conditions are favourable, the peasants are suggested to change their habits of cultivation from one crop to two crops a year, from interplanted double crops to continuous double crops and from planting indica-type rice to Japonica-type rice in co-ordination with applying more fertilizer and reasonable irrigation. These improvements have

already gained some primary results. Regarding the popularizing of reasonable close planting, the number of plants of paddy rice, wheat, cotton and others on unit area are properly increased and production raised in many places. According to 207 experiments carried out in Hopeh Province on wheat, close planting together with other technical measures, the average yield per mou has been increased by 27 percent. The experiments on close planting of paddy rice done in 471 units in Hunan Province show that proper close planting of paddy rice can at least increase production by 17 percent. As to crops like maize, millet, sorghum the space between rows and between plants has been properly adjusted on their original basis; the method of thinning out of young plants and cultivating in due time and the centralized application of fertilizer have been extended. In addition, the methods of cotton pruning, artificial auxilliary pollination of maize and applying the auxin 2—4D' to promote the early ripening and big crop of tomato have been put to use. The results of increased production are very significant.

Culture of the fertility of land: To use large quantity of suitable manure and human excretions which contain rich organic matter, or to plant green manure crops are the important methods used by our peasants in fostering the fertility of land and promoting the output of crop. In paddy rice area of South China, the fallow land is utilized to plant *Astragulus sinises* and vetch (*Vicia sativa*) so that the area of green manure has reached over 48 million mou (3,200,000 hectares). In north China, the area of green manure crop also has been expanded year by year because many fallow and waste lands have been used in planting alfalfa and *Amorpha fruticosa*. To open up the resources of fertilizer in all ways, the method of cutting grasses and mixing with river mud to make composts is being brought into use in many places. The institution of agricultural research have given particular attention to study measures of cultivating green manure, popularizing bacterial fertilizer, out-root top dressing and reasonable application of fertilizer for various crops.

In the field of amelioration of soil, the Chinese Academy of Science together with all institutions of agricultural science and research have carried out soil, survey, studying the utilization and improvement of alkaline and saline land, and the red soil. For instance, in Shiao Tsen area of Tienstsin, the average yield per mou on over 500,000 mou of alkaline land is 730 catties as the result of applying the method of drainage and washing alkalis and by other

agricultural improvements. In some places where the water conservancy and irrigation works are available, the survey on soil and agricultural technique has been carried out. In irrigation, we are promoting to use ditches and to build ridges in dividing the field into small plots and to supply water in fixed quantity in order to change gradually the method of overflowing and minimize alkali areas step by step. Besides, the effective method of conservation of soil already used among the masses has been popularized so that signs of serious erosion have decreased considerably and production of crop raised.

Protection of Crops: In accordance with the principle that prevention is better than control, our departments of agriculture at all levels organize all units concerned to carry out an over-all research work for preventing and controlling various crop pests. In history, the plague of locust is the most serious. Locust outbreaks were recorded in history as far back as 707 B. C. Eight hundred outbreaks of locust occurred in the past 2,600 years. With the establishment of the system of prediction and forecast, supply of huge quantity of insecticide and insect control equipment and preparing the control work in advance therefore, the locust plague has been effectively checked. Paddy stem borer is a common scourge in paddy rice area. But since we have mastered their habit and their outbreak, a campaign for controlling paddy stem borer has been developed so much so their damage has decreased year by year. As to wheat midges, apart from a midge-resistant wheat variety '6028' bred by the Northwest Agricultural College, many effective controlling methods have also been created in different places. In areas where wheat smut is serious the work for treatment of seeds, such as soaking seeds in lukewarm water and mixing seeds with insecticide are applied. For instance the average rate of infection for the wheat in the Western part of the Inner Mangolia Autonomy has been reduced from 10 per cent to one percent. In Shantung Province, wheat smut is also practically wiped out due to the popularization of the method of sowing disinfected seed and well fermented stable manure and sowing the seed separately with manure. In co-ordination with the work of control of pest, our country has manufactured large quantities of sprayers, dusters, benzene hexachloride and other insecticides and insect-control equipment. From 1949 to 1954, 76,100 tons of agricultural chemicals, 940,000 sets of liquid sprayers and 44,000 sets of dust sprayers have been supplied by the Government.

Animal Husbandry and Veterinary: A strain of fine wool sheep of dual purposes for wool and meat is bred out in Sinkang Province.

Its weight is 45 to 65 percent heavier than the local strain. The quantity of wool sheared increased six to eight times and the length of wool staple is over seven centimeters which is good for spinning fine yarn of 60 counts. The East China Agricultural Research Institute has experimented with success with a purple crystal vaccine for hog cholera. Evidence shows that vaccine is safe and effective, both its term for immunity and preservation are above one year. The cost of vaccination for each hog is only one twentieth as much as the past method of inoculation of blood serum. It is now being popularized in large quantities. The vaccine for rinderpest improved by the North China Agricultural Research Institute is effective both for ox and water buffaloe. Furthermore a kind of vaccine special for rinderpest of yak in provinces of Chinghai and Sikiang has been invented. In the past five years after liberation, 300 million litres of various biochemical drugs were manufactured and more than 58 million head of livestocks were protected and cured. Rinderpest has been virtually wiped out upto 1952. After prevention and control, the spread of foot and month diseases and anthrax has been stopped, the rampancy of erysipelas, Emphasysematus gangrene and new castle of chicken have declined.

During the development of the patriotic campaign for increased production, many records of increasing production on large area are created, and many model peasants with bumper harvests to their credit have come into the national limelight. For instance in the Cahyoyan county of Helungkiang Province, the experience of bumper harvest which already existed in the area has been widely introduced. As a result, the grain production of the whole country in 1952 was twice that of 1951.

In area of Chao Shan, Kwangtung Province the local experiences on increased production of paddy rice have been extended. To the early rice, the measures are: Soaking seed for priliminary sprouting, culture for vigorous seedling, early sowing and transplanting, application of more fertilizer, hoeing and intercultivating in proper time and control of pests. The methods for planting late rice are adopted as follows: Selecting good quality seed, fostering large seedling, deep ploughing and fine raking, applying green manure, advancing the time of transplanting, applying fertilizer in different stages, drainage and exposing the field to the sun. As a result in 1953 an average of 1,000 catties of paddy rice per mou was harvested over 500,000 mou of double crop rice land in countries of Chao An and Chen Hai. The national model worker for bumper harvest of

paddy rice, Chen Yun Kang who has created the method of sparsely sowing for vigorous seedling in nursery, and few seedlings in each hole and close square planting secured a high record of 1,433 catties of paddy rice per mou for one crop. In 1953, about 75 to 80 percent of the peasants of Sunkiang County adopted the advanced experience of Chen Yun Kang after a series of demonstrations were held in interlocked way. The paddy rice yield per mou of that county was increased from 400 to 500 catties.

As to wheat, Senshi Province has summarized and popularised the measures of reasonable rotation, applying more fertilizer, selecting good quality seeds, even sowing and close-planting, early and deep ploughing, raking and harrowing in time, sowing in time and irrigating in proper stages. An average yield of more than 300 catties per mou was harvested in five countries embracing over 1·5 million mou of land in that province. As far as back in 1952, the national model worker Li Shun Ta responded to the call of the people's government and organized for developing production. In 1952, grain production of the agricultural co-operatives surpassed the pre-war level by 143 percent and two times over the average yield of Shansi Province. The national model worker of bumper harvest for cotton, Chou Yao Li adopted such cultivated techniques as: preventing drought and keeping moisture in soil, close planting and protecting young plants, frequent irrigating with small quantity of water each time, applying more fertilizer, selecting seeds every year, pruning with care and controlling pests. In 1951, he gained an average of 716, catties of of raw cotton per mou on all his cotton land in which 912 catties per mou was registered on two mou of land. Sze An Fou the model worker for wheat bumper harvest obtained 810 catties of wheat per mou, because he applied the methods of deep ploughing, applying more fertilizer and selecting good quality seed. In 1952, the Farm of Lai Wu county, Shantung Province created a record of 915 catties of wheat per mou. There were other records for the highest yield per unit-area, such as: 10,200 catties of sweet potato per mou in Lu Chow Farm Szechwan Province 661 catties of Soybean per mou produced by Kuo Chi Fou of Honan Province, 1,250 catties of groundnut per mou harvested by Shang Chen Kia agricultural producers' co-operative in Shantung Province, 22,000 catties of tomato per mou produced by Lu Chan Kia and 24,000 catties of cabbage per mou by Sun Tou of Pekking.

*1 cattie = 1·1 lb.

Following the development of agricultural producers' Co-operatives, many changes have taken place in agricultural labour organization and management, technical measures as well as operation of field work. As the advancement of socialist industrialization of our country progresses, large number of tractors and other new equipment will be supplied to agriculture. Mechanization in our agriculture will be realised step by step on the basis of cooperation. Upto that time, we not only can produce more from the cultivated land now existed, but also the large-scale reclamation and cultivation on the broad area of waste land will be possible.

With a view to make agricultural science and technique to cope with the requirement of the development of agricultural production, we are now readjusting the institutions of agricultural science, strengthening the research work in order to fully bring out the function of agricultural science and technique in the socialist reconstruction.

We are now going to build a prosperous ond happy country of socialism. We need peaceful circumstances for the rapid development of our production to satisfy the ever-growing demand for material and cultural life of our people. Under the leadership of Chairman Mao Tze Tung, the great leader of the Chinese people, the future for the development of our agricultural science will be boundless.

AWARD OF MASTER OF SCIENCE DEGREES

1. Sri S. Gopalakrishnan, B. Sc. (Ag.) has been declared qualified for the M. Sc. degree by the university of Madras, the subject of his there is being studies on copper in cereals.

* * *

2. Sri S. Venugopal B. Sc. (Zool), B. Sc. (Bot) has been declared qualified for the M. Sc. degree by the university of Madras, the subject of thesis being Biananics and Control of the Chief Pests of the common green Manure Crops of S. India.

The Cultivation of Rainfed Deshi Cotton on the Black Soil Area of the Central and Southern Districts of Madras State with Suggestions for Improvement

by

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Introduction: Nearly five lakh acres of black soils in the Southern and Central districts of the Madras are annually cropped with rainfed deshi cotton, comprising more than one variety, known in trade as "Uppam", "Tinnies" and "Karungannies" (1). Uppam is short stapled (22/32" and below), low ginning, coarse linted cotton, spinning only upto 14's warp counts and belongs to the species *Gossypium herbaceum race acerifolium.* It is grown in parts of Central districts and coastal taluks of the Southern districts. Karunganni — *Gossypium arboreum race indicum* is a superior medium stapled (26/32" to 27/32"), higher ginning variety, spinning up to 24's and of higher market value than *Uppam* and is grown in parts of Central and Southern districts. Tinnies on the other hand is a variable mixture of the types and their hybrid derivatives and is intermediate in staple (23/32" to 25/32"). From the point of climate and agriculture the unirrigated deshi cotton tract can be classified into two distinct zones, namely the districts of Tirunelveli, Ramanathapuram and part of Madurai forming a Southern zone and distinct from the Central zone comprising the districts of Coimbatore, part of Tiruchirapalli and Palani taluk of Madurai district. Cotton is raised as a rainfed crop and is sown mostly broadcast with the help of North-East Monsoon rains, though the variety grown and rotational practices differ widely. Improved methods like drill sowing and intercultivation with labour saving implements advocated by the department are yet to become popular in these zones. This paper aims to describe the distribution of the several varieties of unirrigated deshi cottons in the black soil area of the "Tinnies" tract comprising the Southern and Central zone, cultivation practices and suggest ways and means for stepping up the production of the quality cottons evolved by improved agronomic practices.

Existing practices: (i) *Southern zone:* The normal area under cotton in this zone is about four lakhs of acres. The tract receives an average annual rainfall of about 25" during the growth phase of the crop. The rainfall and the black soil conditions obtaining on

the Agricultural Research Station, Koilpatti, the northern-most taluq of Tirunelveli district, may be considered to represent the typical conditions obtaining in the zone. On the western side of the tract however, the soil is comparatively richer and is more favourably placed with reference to amount and distribution of rainfall. The black soils in the coastal area abutting on the Gulf of Mannar are deeper and stiffer. They crack more deeply and extensively than the soil in the hinterland. From the topography, it is seen that the general tilt of the land lies towards the gulf in a south easterly direction. Waters from the elevated western ridges drain over this area. Partly due to this and partly due to this being heavy soils, it takes a longer time for the soil to get into condition for sowing. Besides, the North-East Monsoon commences here two to three weeks later than on the western fringe. Cotton sowing therefore begins late, a little in advance of the closing phase of the rainy season. The time of sowing in the southern zone generally depends on the amount and distribution of precipitation of the North-East Monsoon during the prevalence of which nearly half the total annual rainfall may be expected normally. Sowing period extends from September in the west and north west areas of the zone to November in the east and south east. The variety that is cultivated in the western regions is usually *Karunganni.* From long experience the farmer in the eastern areas finds that *Uppam* is able to do better than Karunganni which being earlier runs the risk of exposing its bud and bolls to the untimely rains in February resulting in their shedding. *Uppam* is able to escape this contingency by its late habit and is better adapted than Karunganni to withstand the distress conditions associated with heavy black soils due to its relatively deeper root system. A mixture of these two varieties and their hybrid segregates is also cultivated in certain areas within these two regions. Ramaswamy Mudaliar and Balasubramaiam (5) surmise that *Uppam* is not indigenous and has been introduced more than a hundred years ago.

Preparatory cultivation all over this zone consists of two to four ploughings with the country plough. Cotton is generally sown broadcast. Drill sowing is adopted to a limiled extent by a few enlightened farmers in parts of Kovilpatti Taluq. This is done with a country seed drill (the 'gorru') with three or four tynes and the seed is later covered with th 'guntaka' (blade harrow). A seed rate of fifteen to twenty pounds per acre is used in when boardcasting. The ordinary rotation is 'cumbu' (*Pennisetum typhoides* S. & H.) or 'irungu cholam ;' a variety of cholam (*Sorghum dochna*) sown thick

to provide fodder for work animals, followed by cotton. In a few places cotton is raised year after year without any rotation. In parts of Madurai District cotton is preceded by *samai* (*Panicum millare Lamk*) or *tenai* (*Setaria italica - Beauv*) and followed by cholam. In most of the talqus the major area is under a pure crop of cotton. In the case of mixed cropping, coriander, black gram, grount nut, tenai, and horsegram form the subsidiary crops in the mixtures. These are sown behind the country plough in rows six to eight feet apart. Generally cotton does not receive any manure. The previous cumbu crop in the rotation receives farmyard manure at 20 to 25 cart loads per acre. If the previous crop is *irungu cholam*, it is sheep penned occasionally. One hand weeding is given when the crop is about a month old. By way of after cultivation the field is hand-hoed twice at intervals of 15 to 20 days. Harvest commences in February and is usually over by the end of April. Payment to labourer is usually given in kind. The average yield for this zone varies between 250 and 280 lb. of kapas per acre. If good and timely summer showers are received in April, a second flush is also obtained during which a quantity of kapas ranging between a tenth to a third of season harvest is gathered.

(ii) *Central Zone*: The black soil areas of Coimbatore constitute the major part of the zone. The soil is fairly deep. Stretches of undulating land lie unbunded resulting in soil erosion to a great extent by the monsoon rains and by the strong westerly wind that prevails for nearly four months from June. As a result, the fine particles of soil are carried away by the wind from the fields. Generally, sowings of dry cotton commence with the onset of North-East Monsoon rains received in October and are over within the third week of the month. The average rainfall in this area during the crop period varies from 12″ to 18″, received mostly in the North-East Monsoon season. The variety cultivated is mainly *Karunganni*. In insolated pockets the ryots prefer to grow *Uppam* either in pure form or mixed with *Karunganni*. The major portion of the crop is raised under rainfed conditions though some ryots grow *Karunganni* under irrigation. In such cases two to three irrigations only are given during the driest part of the season,-December and January.

Two to four ploughings by country plough are given by way of preparatory cultivation. Cotton sowing is done by broadcasting the seed, the only method followed in this tract. The seed is covered by working the country plough. The seed rate adopted ranges from 15 to 20 lb. per acre. In all the places the major area is under pure

crop while in a few places coriander, bengalgram and tenai are grown as mixtures. In this tract also the rainfed cotton is not generally manured. 'After cultivation' consists of one hand weeding given when the crop is nearly a month old and one to two hand hoeings given at an interval of 15 to 20 days. Pickings commence in February, and are generally over by the end of May. The average yield for this tract varies from 200 to 250 lb. of seed cotton per acre.

Improved strains under distribution and further trials: Depending upon the suitability of the tract two strains, viz, K. 2 and K. 5 obtained from inter-arboreum crosses and evolved at the Agricultural Research Station, Kovilpatti and the Cotton Breeding Station, Coimbatore respectively, are now in general cultivation in the Southern and Central districts of the State respectively. It was found desirable to grow one cosmopolitan strain of arboreum cotton for the entire area to maintain purity and prevent the malpractice of mixing. The objectives set forth for the evolution of such a cosmopolitan strain were that it should be able to (1) withstand the ill effects of untimely rains of February - March in the south (2) possess a ginning outturn of 34% or more, (3) have a staple length of over 15/16" (4) spin 40's standared warp counts and (5) give an average lint yield of about 150 lb. per acre as detailed by Kalyanaraman and Radhakrishnan (2) To achieve these objects work is progressing at the Agricultural Research Station, Kovilpatti. It was found that four long linted cultures, namely 6186-9, 6188-8,, and 6312-A gave consistant and encouraging results in the trials conducted at the breeding stations in Kovilpatti and Coimbatore. These were tested for the first time during 1952 - 53 on representative cotton areas in the central and southern districts to ascertain their adaptability levels. Results from these trials for three consequtive seasons indicated that all the cultures were found to be as adaptable as the local. Besides, the ginning percentage and halo-length of these long linted types were significantly higher than those of the locals (3). Of these, culture 6186-9 was finally found to be the best cosmopolitan strain to replace the existing strains of K. 2 and K. 5.

Further scope for improvement in cotton cultivation: A review of the cultivation practices followed in these tracts reveals that there is great scope for improving the yields of the crop, besides the use of seeds of improved strains. Improvement in the method of sowing, nature of preparatory cultivation, manuring practices, after cultivation practices are important considerations. The improved practices of working 'guntaka' for levelling lands after ploughing and

covering the furrows after sowing, using seed drill (Gorru) for sowing and using 'danthi' for intercultivation are not in vogue anywhere in the Stote. In these years of successive droughts and abnormal weather conditions the practices adopted by the dry land cotton farmers of the tract would seem to be far behind the requirements of the times and needs. Neither climatic nor local conditions could be impediments in the way of the cultivators for the adoption of improved practices for improving the crop. Their use is economical, efficient and simple. The following methods are recommended to improve the yield of the unirrigated cotton crop.

(1) Bringing the field under plough soon after the harvest of the previous crop, and breaking clods by the use of 'guntaka' to settle the soil and conserve much of the rain water.

(2) Putting temporary bunds across the slope and along contour for checking soil erosion, conserving the rain water and prevent 'runoff'.

(3) Working 'guntaka' prior to sowing to form a good seed bed and securing a good initital stand of the crop.

(4) Using chemical nitrogenous manure like ammonium sulphate at the rate of 100 lb per acre to supply 20 lb of nitrogen just prior to sowing. An increase of 37% has been obtained at the Agricultural Research Station, Kovilpatti by applying 40 lb of Nitrogen per acre in the form of ammonium sulphate.

(5) By the adoption of drill sowing with the help of '*gorru*' which enables the use of '*danthi*' for intercultivation when the crop is in the land.

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Australian Sugar Industry

by

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Sugarcane was first grown in Australia in the year 1817 though the first commercial plantation commenced only in 1865 in New South Wales. As soil and climatic conditions in Queensland were more favourable for the successful cultivation of cane, the industry gradually extended northwards till at the present time 80% of the entire cane is produced in the tropical regions of Queensland. In 1953 – '54 the total area under cane in Australia was 481,602 acres. There are 34 mills, 14 of which are co-operatively owned by the growers and the rest proprietory. The following table gives the various sugar districts with their rainfall and the number of mills in each of them:

	Districts	No. of mills	Rainfall
1.	Mossman to Ingham	10	80 to 180″
2.	Lower Burdekin	4	43″
3.	Mackay – Proserpine	8	65 to 70″
4.	Bundaberg – Maryborough	7	44″
5.	Nambour – Beenleigh	2	48 to 63″
6.	Narwood in N. S. W.	3	,,

Mossman and Mackay are in the high rainfall tropics, while the Lower Burdekin is in dry tropical belt and is essentially an irrigated area. The others are sub-tropical and most of the crops are grown with rainfall only, though irrigation is being used on considerable acreage in Bundaberg.

Cultivation of cane is confined to the narrow eastern coastal strip, about 30 miles wide, of Queensland and New South Wales, and it extends to a length of about 1,300 miles from Mossman ($16\frac{1}{2}$ Latitude S) to Clarence river in N. S. W. (29·5 Latitude S). Climatic and soil conditions vary. The areas receive their heavy rains during summer (December to February) though fair to heavy rains are received in the other seasons also. The soils are of volcanic origin in many of the areas except in Lower Burdekin Delta and extensive irrigation is practised with the aid of pumps working in shallow bores.

AUSTRALIAN BANANA INDUSTRY

The New South Wales banana industry is valued at between £A 4,000,000 and £A 5,000,000 annually, producing 1,750,000 cases a year. Average production to the acre in New South Wales is calculated at 72 cases on non-irrigated land, 300 cases under irrigation. A case weighs about 80 lbs.

Experts regard the use of plastic bags to cover young fruit as the most important innovation in the banana-growing industry. Used to protect growing bananas in winter and spring months and intensify sunlight, they produced a larger and more mature banana.

As with the sugar industry obtainable in all parts of the world, Australian Sugar Industry also was formerly organised on Plantation basis, with 166 inefficient plantation mills. Indentured labour from South Sea islands was extensively employed. But with the coming in of federation in 1901, employment of coloured labour in all the industries, specially in sugar industry was prohibited, the coloured labour repatriated and various inducements given to encourage European settlement in the area. The result is that at present the entire sugarcane cultivation is based on the typical Australian pattern of one man ownership and operation. In place of 166 inefficient mills there are only 34 mills which mill 7 million tons of cane per annum. The entire work is carried on with white labour. All the operations are highly mechanised. The labour employed even in factories is surprisingly small. A factory with ac rushing capacity of 2,400 tons per day employs about 30 persons per shift on the manufacturing side with 12 persons in the Loco section.

Australian Sugar Industry is a protected industry. Import of foreign sugar is not allowed and the industry itself, through the Queensland Government, has taken up on itself the responsibility of supplying the entire Australian requirements of refined sugar at a fixed price (the present price is 10 pence per lb. in retail) and providing the Australian manufacturers of jams and other preserved food stuffs with enough sugar at such prices as would be obtained in the free world market. This sugar industry supports directly or indirectly 200,000 persons in Queensland alone — almost one-fifths of that State's population. Apart from the need to make the country self-sufficient in sugar and earn a substantial exchange by exports (valued at £ 21·7 millions in 1952 – '53), it is considered as of paramount importance to the Nation to develop the northern areas of the country and habitate them with white population in the interests of security and military strategy. The need for this development has been felt specially since the World War II.

Possibilities of expansion of sugar industry in the country are great. Given sufficient export markets at attractive prices for sugar, the industry can increase its production manyfold, as enormous stretches of land suitable for cane cultivation are available. But since the export quota of Australia as per the International Sugar Agreement and the Empire Sugar Agreement is restricted to 600,000 tons of sugar per annum, a number of restrictions have been placed on the industry to balance the production against anticipated demand at economic price level. Each mill is allotted a maximum

quota of sugar (Peak) it can produce each year and this quota is distributed among the registered suppliers of cane on the basis of supply in a specified year.

The average size of the farm is about 60 acres with an average production of 1100 tons of cane per year, though there are farmers owning very large blocks under cane. Each farm is self-contained with dwellings and all machineries and quarters for cane cutters. Each farm is allotted a net assigned area, the maximum area of cane in any one year and a peak (the maximum tons of cane that it can supply to the mill in any one year). Usually three-fourths of the gross area of a farm is the net area, and it is this area which is to be under cane every year, the rest being fallowed and/or green manured. In the case of a farm of 60 acres gross, 15 acres under first ratoon, 15 acres under second ratoon and the rest fallowed. Steps are taken to see that a farmer does not plant an area in excess of the farm's net area and the millers are prohibited from accepting cane from any area other than that allotted. This system of gross and net assignment allows the fields to rest once in four years and enables the farmer to enrich the soil by growing a green manure crop. In general, cane farmers specialise only in cane and do not have any other crop. The allotment and revision, whenever necessary, of the peaks and the net assigned areas are determined by the Central Cane Prices Board and local Cane Prices Board constituted under an Act of the Queensland Parliament.

Priliminary Cultivation: The stubbles of the preceding crops are uprooted in June and the crop residues cut into pieces and incorporated into the soil by working disc harrows, rotary hoes, disc plough or their implements drawn by tractors of different sizes. The land is further worked by grubbers or disc harrows to prepare a suitable seed bed for sowing legumes in September. The type of greeen manure chosen depends upon the locality and the time available between now and the time of planting cane. Velvet beans (*Stizolobium* Sp.) have a long growth period, are drought resistance, wilt resistant and produce heavy mulch of dead leaves on the soil surface while the vine is still growing. Cow peas are preferred where a short duration crop is required. The seeds are usually grown in lines 4' 6" apart to reduce the seed rate and facilitate intercultivation when the vines are yet to cover the entire field. These green manure crops make rapid growth with the onset of summer in November and give a final yield of 10 to 16 tons of green matter per acre, when they are

ploughed in January. The land is disced with harrows to disintegrate the green matter and the soil is compacted well with rollers. The green matter decomposes entirely in about 2 weeks' time. Further working is done with grubbers (rigid tyne cultivators) until a good seed bed to a depth of one foot free from clods is obtained.

Planting: Time of planting varies with latitude to allow of sufficient soil moisture and high soil temperature during germination of setts. In North Queensland planting is usually done during April — May after the heavy summer showers. In South Queensland and N. S. W. planting is done either during autumn (February – March) or during spring (Augst – November). Since all after - cultivation is carried out with tractors, it is found esesntial to have a spacing of 4′ 9″ to 5′ 3″ between rows of cane. Planting is done by planting machines which cut the cane into setts of suitable size, dip them in or spray them with a solution of Aretan (organo – mercurial compound) and plant them in furrows opened by the machine, cover the setts with soil and compact the soil above the setts. In certain localities where application of fertilizers is done at the planting time a fertilizer box is attached to the machine. A single row planter requires one man to feed the canes to the chute and a double row planter requires two men to feed the cane. In either case, there is, in addition, a driver to drive the tractor. A single row planter worked by a 22 H. P. tractor will plant 4 to 6 acres per day and a double row planter worked a 40 H. P. tractor will cover an area of 12 acres per day of 8 hours. A single row cutter – planter will cost £ 133 while a planter with a dipper or spray attachment for Aretan will cost £ 250/–

Only whole canes of 10 to 12 months old are used for seed purposes. Great care is taken to discard diseased and unthrifty canes and canes with prominent eyes. Each sett is of 3 buds, 14″ long and are planted singly end to end 4″ apart at a depth of 9″. Two tons of cane or 10,000 setts are required to plant an acre. There are 6 to 8 buds for each yard - length of furrow. Use of 'Aretan' to prevent the onset of pineapple disease, protect the canes against adverse conditions of soil and to hasten germination of buds is universally practised. The cost of the treatment is 10 to 15 shillings per acre.

Varieties: Considering the total area of cane, the number of varieties of cane one comes across in any one area is remarkable. Each mill area uses a couple of varieties and each individual farmer has more than two to three varieties growing in his farm. Having

more than one variety is a sort of insurance against total loss due to possible damage to a variety by disease or by adverse climatic conditions. They also aid in spreading over the harvest programme over a longer seasan without any deterioriation to cane. A few farmers who placed all their reliance on only one variety Pinder, suffered heavily this year in Queensland on account of the tops breaking off at the time of heavy cyclones this January. Trojan and Badisla varieties of cane in the nearby fields were entirely unaffected by the cyclone.

Each mill area has a list of approved varieties prescribed every year by the Bureau of Sugar Experiment Stations, a quasi—government body in charge of sugarcane work. It is an offence to grow any variety other than those approved.

At one time Co. 290 and P. O. J. 2878 reigned supreme in the area, but on account of their susceptibility to many of the diseases, they have been discanded in favour of other superior varities. Farmers have a wide choice of suitable varities to choese from and they do not hesitate to take up to new ones.

At the present time 35% of the entire cane area is covered by varieties bred by the Bureau of Sugar Experiment stations, 42·6% by varieties from the Creeping Stations of the Colonial Sugar Refining Company and 22·4% of the area is covered by canes imported from foreign countries. The performance of a few varieties is outstanding and there is no doubt that the higher efficiency and higher sugar recovery of the Australian industry are, to a very great extent, due to these varieties. Some of these varieties can be imported and their performance tested in typical sugarcane farms in India.

Aftercultivation: During adverse seasonal conditions when tractor cannot gain entrance to the fields pre-emergence sprays of 2—4D are used in certain localities to prevent germination of weeds and for giving the seedlings a good start. But in the majority of the areas weeding is done with the help of a "cotton king" with spring tyne aattachments. The implement consists of two sets of 3 reversible discs of 16" diameter on either side with 5 or 6 spring tynes in the centre. The disc cultivates the interspaces between the rows of cane and the spring tynes weed and stir the soil right in the row of cane without damaging the germinating buds or the shoots. A single row "cotton king" is worked by a light tractor (20 H. P.) and covers an area of 10 acres

in 8 hours. In irrigated areas ($12\frac{1}{2}$% of the entire area) cultivation is done as and when necessary and in times of extreme dry weather, the soil is thrown a bit inside the rows with the use of 'cotton king' to conserve the available moisture. In all cases soil is thrown into the rows of crop bit by bit as the crop grows till the entire furrow is closed and a small ridge is formed along the rows of cane. Final weeding and earthing up is done by a tractor drawn implements. No cultivation is done once the crop has grown out of hand. Hand weeding or chipping as is done in India, is unknown. Even in a 70 ton crop (with canes 6 ft. long) in the irrigated farms, the ridges formed along the rows of cane are not more than 6 to 9" high from the bottom of the adjacent furrow and the canes do not seem to lodge on account of the low ridges.

The ratoon crops, usually two or more, are treated the same way except that at the beginning the stubble is 'shaved' or cut to the ground level by disc harrows or shubble shavers to allow new shoots to come up from the ground level and not from the crown of the ridge.

In Burdekin area, irrigation is given at three-weekly intervals, the maximum number of irrigations being 10 to 12 per year. The cost of lift irrigation varies from £ 12 to £ 15 per acre per annum.

Sugarcane arrows in almost all the tracts in April – May, the intensity depending upon the variety and the locality of the farm.

Fertilizers: Payment for cane in Australia is based on the quality of cane and every endeavour is made to obtain a crop of high sugar value. The farmer is interested in the tons of sugar produced rather than in the tonnage of cane alone. Since exhorbitant rates are to be paid for the harvest of lodged canes and since the sugar content goes low in a lodged crop of cane, formers always prefer to have a crop of erect cane of normal tonnage and of high sugar content to a heavy lodged crop of luxurant growth but of low sugar value. All fertilizer practices have this in view. The bureau has an elaborate advisory service which enables every farmer to have his soils analysed every fourth year free of cost. Nitrogen is always assumed to be deficient and hence determinations for phosphorous and potash status of the soil alone are made. Based on the results of analysis proper fertilizer recommendations are made to the farmers.

As already stated, a majority of the farmers grow a green manure crop which is estimated to add 200 to 300 pounds of nitrogen per acre. In addition, many farmers have begun applying molasses at the rate of 4 to 8 tons per acre and/or filter press mud at the rate of 10 tons per acre as a basal dressing. In fact as much as 28% of the production of molasses is utilised as fertilizers to cane field. These mill waste products are made available to farmers either free (mostly by co-operative mills) or at a nominal rate (£ 2 to 3 per ton of molasses) by proprietory mills. These products are reputed to improve the texture of the soils besides being of some manurial value. In certain mills a mixture is made of molasses and press mud in the proportion 2 parts of molasses and one part of mud and supplied to the farmers at £ 2 per ton. This mixture is easy to handle.

In irrigated Burdekin area, where no green manuring is practised, a suitable planting mixture (17% P_2O_5, and 7·5% K_2O or 8% P_2O_5 and 25% K_2O according as the soil is deficient in P or K) is drilled into the soil at 3 cwts. per acre during planting time. In addition, a top dressing of 2 to 3 cwts. of ammonium sulphate is applied close to the crop rows when the crop is about 7 months old. In dry areas a suitable of mixture (12 — 5·5 — 7·5) is drilled in at the time of planting at the rate 3 to 6 cwts. per acre and no further fertilizer is applied. Experiments carried out by the Bureau indicate that all the fertilizer requirements of the crop can be applied in a single dose and that no advantage is gained by applying the fertilizers in two instalments.

Harvest: Cane is harvested when the crop is 12 to 14 months old. In certain areas of Southern Queensland and in New South Wales where stand - over crops are found, cane is harvested only when they are 22 to 24 months old. The universal practice in the country is to burn the crop prior to harvest. This involves the burning of all dry leaves before cutters enter the yield. The quality of cane does not suffer appreciably by the pre-harvest burning, provided the canes are delivered within 48 hrs. Harvesting is usually done by manual labour by gangs who are specialists in this work, and they are paid for at the awarded rate of 13 to 15 shillings per ton. A gang consists of 3 to 4 cutters and a cook who also shares their wages. An average cutters will cut 6 to 8 tons of cane per day of 8 hours. Cane cutters have a 40 hour week and labour laws regulating hours of work, rates and methods of payment, provision of quarters and of equipment to be provided in the house and settlement of disputes are elaborate and are strictly observed. All cane

cutters, in fact all labourers, should be members of the Australian Workers' Union.

The canes are loaded in trucks of 2 to 2½ tons capacity on temporary tram lines of 2 feet guage laid on the farm and the loaded trucks handed over to the mills at fixed delivery points near the farm. The Australian mills maintain 2000 miles of tram lines and it is the responsibility of the mills to have the loaded trucks hauled up to the mill. A very small percentage of the crop is delivered to the mills by other means of transport like motor truck, railway and boats.

There are a few sugarcane harvesting machines in operation in some of the larger plantations. These machines cut the canes, top them, and throw them in convenient bundles to be loaded into trucks by front-end loaders worked by light tractors of 22 H. P. A two-row machine harvests about 60 tons of cane per hour and a one-row harvests about 25 tons of cane per hour. The cost of machine varies from £ 3000 to £ 5000. Attempts are being made to perfect the machine and make them available to all the farmers at a reasonable cost, as the manual harvesting of cane is cumbersome and costly; and accounts for the major portion of the costs of production.

Handling of cane, while cane is transferred from one truck to another or from trucks to railway wagons, is mechanised with the aid of "derricks". The yield of cane varies from 25 to 30 tons per acre in dry areas and 50 to 60 tons per acre in the irrigated districts. The cost of production of a ton of cane is about £ 2—6—0 in irrigated districts and sightly less in dry areas. The average C. C. S. (Commercial Cane Sugar) content of cane varies favour 12% to 16%.

Payment: Payment of cane supplied to a factory is made not only on the basis of tonnage of cane supplied but also on the basis of commercial cane sugar contained in it. Arrangements exist in all mills to take either a continuous sampling of the first expressed juice as a particular consignment of cane is being crushed or to mark out every fourth wagon in a consignment and take samples from the first expressed juice from those canes. In either case the juice is analysed and with reference to the figures of analysis and the fibre content of the particular variety of cane, the commercial cane sugar content (C. C. S. %) is determined. This CCS figure is not identical with the actual sugar content but is a measure of the recoverable sugar at a certain prescribed standard of factory efficiency. The grower is paid as per scale which provides a premium for high CCS%. Qualified

cane testers are appointed by the Central Cane Prices Board, in each mill to ensure that rules and regulations governing the weighment of cane and taking of samples, are strictly adhered to and the procedure adopted in the laboratories for analysis of juice is in conformity with standard methods. Canes with a CCS persentage less than seven is return to the grower.

One unique feature is that the price of cane paid to the grower is linked to the price of sugar realised by mills. All sugar produced within the peak is termed as *Pool 1* and this includes sugar meant for domestic consumption and for export to the United Kingdom as per agreed prices. All sugar produced in excess of the peak is termed as *Pool 2* and is sold in the free world market at the owners' risk often at a price lower than *Pool 1*. The price realised by a particular mill in 1954 is as follows and is given as an example :

Pool	Destination	% of the total production	Price realised per ton.	
1	Domestic consumption	44·6	£ 47–16–0	Pool 1 average price £ 42—16—0
	Export under agreed prices	55·4	£ 38–16–0	
2	Export to the free world market. (Production in excess of the peak	1124 tons	£ 31– 1–0	

The price thus realised per ton of raw sugar is divided among the growers and the miller in a definite proportion. The price obtained by the grower can be calculated from the formula

$$x = 0{\cdot}009y\,(z-4) \pm \text{adjustment}$$

where x is the price to be paid to the grower per ton of cane supplied y is the price per ton of sugar obtained in the relative pool and z is % CCs of the cane. Adjustment is the adjustment to be made in case the price of sugar goes above or below the price £ 3 35/- per ton (at which figure this formula is held to be true). The figures of adjustment is given in a table. In practice the division of the raw sugar money between the grower and the mill is done in the proportion of 7% (to the grower) and 30% (to the miller). The amount thus realised is distributed among the growers according to the total tonnage and the CCS of the cane. As the whole calculation is based on a certain specified efficiency of the mill, the grower does not suffer on account of the inefficiency of the mill.

Though final payments are made and accounts settled only at the close of the season, interim payments are made to the farmers immediately cane is delivered to the mill as per proclamation (announcing the anticipated price of raw sugar for the season and interim payments to be made to the grower) issued by the Queensland Government at the beginning of each season. The marketing of all sugar whether for refining and home consumption or for export is controlled by the Queensland Sugarcane Board under the Sugar Association Act. A ton of cane analysing 13% CCS is paid at the rate of £ 3-13-0 when the average pool price of raw sugar is £ 42-16-0 per ton. Sugar refining is carried on in separate refineries located in the big metropolitan cities. The sugar mills confine their activities to the production of raw sugar. Except for one refinery in Bundaberg all other refineries are owned by the Colonial Sugar Refining Company, who act as agents to the Queensland Govt. in all matters pertaining to the control and marketing of sugar.

It is evident, therefore, that the farmer stands to gain by supply of quality canes to the mill and the farmer always tries to produce canes with high CCS by the adopting proper manurial and cultural practices. He is always on the lookout for better varieties of cane and demands of the Bureau for supply of suitable varieties to his farm.

Pests and Diseases: Australia is now singularly free from many of the major pests and diseases, due mainly to a system of strict quarantine and regulatory measures adopted over the course of many years. Red rot has been controlled by the use of resistant varieties. A few of the major diseases like the Fiji disease and Mosaic have been almost completely eradicated. Sugarcane grubs, once the major pest, have been controlled by the extensive use of B. H. C. preparations Movements of cane from one district to another cannot be done except under the authority of the Pest Control Officers, and import of cane materials from abroad by persons other than the Bureau is not allowed. A few minor diseases like ratoon stunting disease, chlorotic streak (both believed to be virus diseases) and sun leaf scald (a bacterial infection) are present and they are kept under control by proper preventive and curative measures. Hot water treatment plants for the treatment of sets against ratoon stunting disease are present in all the mills.

Organisations: The Bureau of Sugar Experiment Stations, a quasi government body resposible for research into all spheres of

sugarcane development in Queensland was constituted under the Bureau of Sugar Experiment Stations Act of Queensland Parliament. The Bureau maintains a number of breeding and experiment stations in typical areas of the state. The activities are financed by a levy of 3 pence each on the grower and miller for every ton of sugarcane crushed. The growers and millers have effective voice in the formulation of the policies and drawing up programmes of research.

The Queensland Cane Growers' Council is purely a growers' association. All cane farmers are *ipso facto* members of the council and contribute to its finance by a levy of three quarter penny per ton of cane supplied to the factory. The council is the watchdog of the interests of the growers vis-a-vis the millers. It has on its staff qualified personnel who can speak authoritatively on matters pertaining to the culture of cane and technology of manufacture. The offiicial organ of the council is *The Producers' Review*; a monthly journal of great interest to farmers.

The Australian Sugar producers' Council is an association of the growers and millers and is the mouthprice of the entire industry. In addition, each mill area has its own district executive and pest control board to attend to local affairs. With better varieties of cane, better cultural practices, control of pests and diseases and the effective organisation of the industry, the yield of sugar per acre has risen from 1·81 tons in 1901 to 3·39 tons in 1952—53. 6·8 tons of cane are required to produce one ton of sugar in the Burdein area, the over - all average in Australia being 7·34 tons of cane to a ton of sugar. The Australian cane is the sweetest cane in the world and the yield of sugar per acre compares well with any other sugar producing country.

A note on some responses of Eupatorium glandulosum H. B. & K., to spraying of 2, 4, 5 — Trichlorophenoxy-acetic acid as a weedicide.

Introduction: Eupatorium glandulosum H. B. & K., native to Mexico, is a branched shrub growing to a height of 3 to 6 feet and as recorded by Fyson (1915) it is commonly seen as an escape along roadsides in Ootacamund and surrounding areas in the Nilgris. The plant is very glandular on all the young parts and scented, with a peculiar acrid odour. Leaves are opposite, petiolate, the lamina being almost triangular with a broadly wedge shaped base, crenate-dentate, except on the basal margins. White flower heads are produced in terminal glandular masses. In the course of weedicide experiments on sum important weeds on the hills, isopropyl ester of 2, 4, 5 - Trichlorophenoxy acetic acid was sprayed as a weedicade on this species at 5 lb. acid equivalent per acre in a spray volume of 100 gallons. The responses of this weed to the spray, with reference to some of its morphological features, are describsd in this note.

Observations: The sprayed plants did not exhibit any scorching on the next day of treatment but the tender shoots showed epinasty. The plants did not dry up even after a month's time but fresh axillary growths were noticed. The leaves were also fresh and green, but for a few scorched spots here and there. The petioles of the leaves were coiled up like a spring. The stems were swollen and distorted in many ways, showing profuse growth of roots throughout the internodal regions. These adventitious roots were thin, light brown in colour, varying from one to a few centimeters in length. Initiation and development of roots along the stems and the coiled up petioles are shown in Fig. 1. The roots have actually forced their way through the epidermis. Barring these abnormal growths, the plants were quite healthy and continued to put forth fresh shoots from the axils of leaves.

Discussion: Root initiation on stems of plants is caused by most of the hormone type chemicals and this is utilised in inducing quick rooting of stem cuttings intended for vegetative propagation of many garden plants. Zimmerman and Wilcoxon (1935) mention eight chemicals, inclusive of α - Naphthalene - acetic acid, β - Indole butyric acid and Phenylacetic acid that definitely caused local initiation of roots on growing plants of tomato, sunflower, marigold, artichoke, buck wheat, dahlia and tobacco. It is further stated that Alpha Naphthalene acetic ecid and Indole Butyric acid were specially effective for initiating roots on both stems and leaves. Avery and Johnson (1947) observed that amongst the promising new hormones, trichlorophenoxy acetic and trichlorophenoxy propionic acids were extremely active in inducing root

formation and when used at low concentrations have an advantage over the phenoxy compounds in that they do not affect the normal growth of roots and shoots. These chemicals have been said to be successfully used in rooting roses, apple etc., at concentrations of 50 to 1000 ppm. in talc. On *Eupatorium glandulosum*, the ester of 2, 4, 5, – T had no killing effect even though the chemical was sprayed at a weedicide concentration, but on the other hand there was root initiation along the stems. The stems did not dry up but exhibited only slight distortion.

EUPATORIUM GLANDULOSUM, H. B. & K.

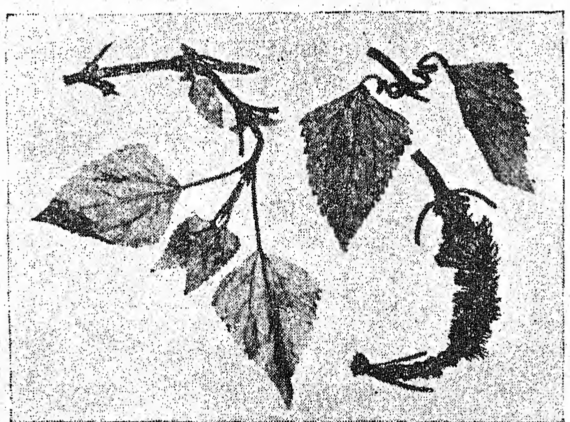

FIG. 1
Sprayed | Control.

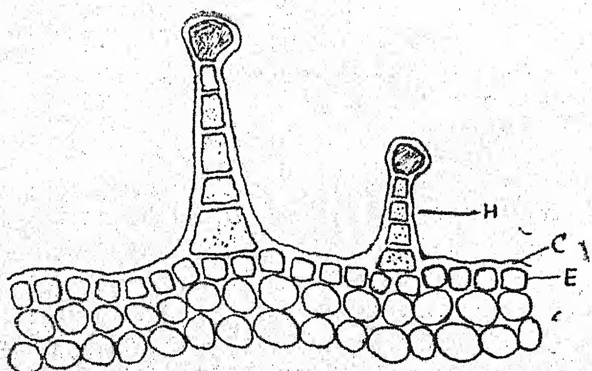

FIG. 2
Stem epidermis showing glandular hairs : × 75.

H — Epidermal hair with a unicellular glandular head.
C — Thick cuticle.
E — Epidermis.

Thus it is clear that wetting, penetration and translocation of the chemical have been much retarded and the chemical had entered the tissues only in such a small dose as to act as a growth-promoting agent. In other words, the plant has been able to resist the action of the weedicide and this is mainly because of the presence of a dense, covering of glandular hairs on the plant body. These hairs are present all over the stems and leaves. On the leaves these hairs are found to be more concentrated on the midrib and veins. Each hair, on detailed examination, is found to have a uniseriate stalk of a few cells with a unicellular glandular head as shown in Fig.-2. Robbins etal (1952) while dealing with the relative resistance of weed species to hormone sprays state that a dense covering of hairs is one of the many plant characteristics that contribute to the resistance of weeds. In this species of *Eupatorium*, apart from the hairy covering of the plant body, there is additional protection because of the glandular secretion. Thus the glandular hairs have prevented intimate contact of the spray with the epidermis. The stem anatomy also showed a thick cuticle on the epidermis, which acts as an effective mechanical barrier against penetration of the chemical.

Summary: The responses of *Eupatorium glandulosum*, a shrubby weed common in the Nilgris, to a spray of isopropyl ester of 2, 4, 5-Trichlorophenoxy acetic acid have been described.

This weed, though a broad-leaved one, is found to be very resistant to the weedicide, mainly because of the presence of glandular hairs all over the plant.

The observations, also indicate clearly that 2, 4, 5-Trichlorophenoxy acetic acid is very active at low concentrations, in initiating root growth in plants.

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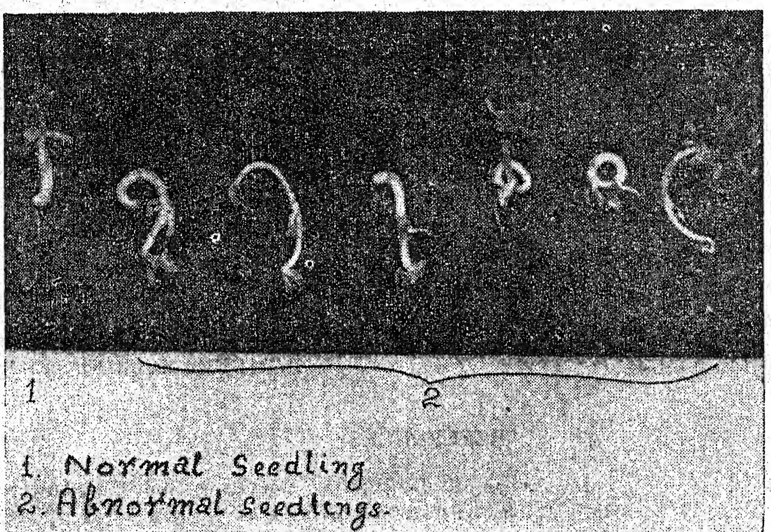
Abnormal Seedlings of Groundnut, Arachis hypoagea Linn.

The groundnut seed germinates on the fifth day in the case of bunch types and on the seventh day in the case of spreading types, under optimum moisture conditions. The period required for germination varies under different conditions. Bouffil (1951)[2] reported that the radicle appears within two days after sowing under Senegal (African) conditions and germination was complete within a week. In America and Germany, 8 to 10 days were required for germination. Ali Muhammed *et al* (1933)[1] reported that germination was complete in the early sown crop within a week and in the late sown crop within ten days at Lyallpur. Under pot culture, germination was noticed to be slightly earlier than under field conditions. Similarly water soaked seeds germinated earlier.

During the course of germination studies on different varieties, forms and cultures of groundnut at the Agricultural Research Station, Tindivanam a few abnormal seedlings were noticed. The abnormal seedlings along with a normal one are shown below in PLATE I.



In these abnormal seedlings, the hypocotyl instead of growing straight and up-ward exhibited a tendency to loop with the epicotyl or portion of the hypocotyl and epicotyl buried in the soil. In some cases the hypocotyl makes a complete loop and again the shoot emerges straight. In other cases, the hypocotyl is unable to lift the epicotyl which is deeply buried in the soil. Under such circumstances, the cotyledonary laterals begin to develop if they happen to be above ground. The plant

is otherwise normal, only with two laterals developing instead of the terminal main stem.

In most of the cases of such abnormal seedlings, the cotyledons are also found underneath the surface of the soil and further development does not take place. The main apical shoot is found to decay after some days.

The occurrence of such abnormal seedlings are rare being 10 or 12 in a field with a population of 60 to 80 thousand plants. The occurrence of such seedlings was sightly more common in fields where the seeds were sown by punching a hole in the ground, putting a seed in it and covering it with moist soil by hand, than in fields where sowing was done by dibbling seeds behind country plough.

Whether the depth of sowing was responsible for such abnormal behaviour of the seedlings was considered. Pot culture experiment was carried out with sowing seeds at four different depths, viz., 1" 3" 6" and 9". It was found that the germination was delayed as the depth of sowing increased but the seedlings were normal. On pulling out, it was seen that the collar was situated approximately at the point of placement of seed and the hypoctyl elongated until the cotyledons were pushed to the surface of the soil. Thus the length the hypocotyl varied according to the depth of sowing. This is in agreement with the findings of Bouffil (1951)[2].

Such abnormal seedlings were reported by Krishnamurthy and Srinivasan (1953)[3] in Dolichos lab-lab due to toxicity of 2, 4 Dichlorophenoxyacetic acid when the weedicide was sprayed as a pre-emergence control. Whether such toxic action may be the cause of such abnormalities, was determined by conducting pot culture experiments where pre-emergence spraying of 2, 4 D in herbicidal concentration (i. e. $2\frac{1}{2}$ lb. of Ferenoxone in 100 gallons of water) and no treatment were compared. It was seen that germination was inhibited by the weedicide and that abnormal seedlings were also found. But there is not sufficient reason to infer that the occurrence in the fields is due to any such toxic action.

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Gleanings

Agriculture in the World Economy: Agriculture is the world's largest primary industry. Approximately three-fifths of the world's population, or more than 1,400 million people, live on farms. Of the total farm population of 913 millions, or 65 per cent live in Asia and 153 million or 10 per cent in Africa. In most countries, there has been a sharp decline in the percentage of farmers during the last 150 years. Only 9 to 10 per cent of the world's land resourcet (29,345 millions acres) consists of cultivated land ! 17 per cent are meadows and pasture and 29 per cent forests. Nearly half the land, 43·5 percent is not used for production. From the point of production, grain yields have increased by 5 per cent with the help of scientific development, while in the U. S. A. alone, the increase has been 26·5 per cent. The largest number of cattle are found in Asia, where they serve as draught animals and as producers of milk. The highest number of horses are in Latin America and Europe. The study forecasts that 50 to 60 million tons of fish could be caught each year instead of the present 25 or 30 million tons without endangering exhustion of stocks and future yields.

The world's forest resources seem adundant enough to meet forseeable needs, taking into account both population growth and acclerated demand caused by increasing literacy. Excluding the U. S. S. R., the world produced 640 million tons of grains (wheat, rice and maize etc.), 37 million tons of sugar, nearly 155 million tons of potatoes, 40 million tons of meat, about 30 million bales of cotton and one million ton of wool in 1952. Among farm products, milk ranks first in value followed by meat and high calorie foods such as cereals and sugar. In regard to farm machinery, the use of tractors has doubled since the end of the war and in 1952, there were 6·3 million tractors in use. Agricultural production has to be stepped up to provide an additional plate of food for every five plates now provided by 1957. In order, to improve the sub-normal nutritional levels of Asiatic countries, a seventh plate will be necessary. (FAO review)

All Synthetic Diet: A major step forward towards the development of the long fictionalised synthetic food, which will provide an entire nourishing meal in one pill or capsule, has been made in the United States. Four biochemists of the U. S. National Cancer Institute Laboratory reported their development of an all synthetic, complete diet. Tested on rats, they showed greedy enthusiasm for the food and flourished on it. Even though, no chewing was needed for the synthetic food, the rats developed fine, healthy teeth. The diet was developed as an emergency measure to assist doctors faced with the problems of feeding premature infants. The synthetic food is made up of powdered amino acids, organically bound phosphate, crystalline vitamins, glucose and salts. About forty ingredients go into the final product, which is a white powder that is completely soluble in water. The food is given in liquid form. Essential fats and fat soluble vitamins are supplied as a separate liquid. Male rats on this diet proved fertile and female rats bore and suckled their young as competently as sister rats who ate conventional foods. The results indicate, that the new synthetic diet may be an important step towards the development of hearty sustaining meals in convienient capsule form. (A H S)

Cashew Shell Oil Uses: (Farmer, May 1956). In recent years close attention has been directed to the production of moulded clutch and brake facings, consisting essentially of asbestos fibres and various fillers. These are bonded under heat and pressure with a powdered thermo-setting resin. Modifications of this process has comprised in the use of binder resin in the form of a solution and the extension of the resultant mixture. The most successful of these dusts have been based on resins produced from cashew shell oil. It is a corrosive poison similar to

cerbolic acid and is used in a variety of processes, including the manufacture of insultating materiala, plastics, varnishes and insecticids. Friction dust for brake and clutch facings are usually obtained by grinding the fully cured product of cashew shell oil polymer with an aldehyde. Marked increase in performance particularly in reducing wear at higher temperature is obtained when 5–15 per cent of cashew shell oil friction dust is included. Binder resins of both solid and liquid types have been produced from the reaction of cashew shell oil phenol mixtures with formaldehyde and these give compositions which mould excellently and have high frictional values. They are now in wide use, although the manufacturers of facing materials are still reticent about them.

Cashew resins in solution are used for impregnating woven asbestos facings, and as binders in the wet mix process. In powder form, cashew resins are employed as binders and as friction dusts in the making of moulded brake facings and smooths out irregularity in friction coefficients. As the cashew shell oil resin is a naturally occuring phenolic body, it is particularly useful in termite attack. Vehicle manufacturers use chashew resin for protective coverings for metal components as well as for clutch and brake facings. Other miscellaneous applications are also being considered. These include wetting agents, antisludge agents for lubricating oils petroleum antioxidants, and non-bituminous coatings for underground structure exposed to corrosive soils. (S. V. R.)

Atomic Preservation of Food: (Indian Express): The remarkable benefits that atomic energy may give the world are in respect of food preservation. Potatoes may not sprout or rot for years; meat and milk may be preserved for weeks without refrigeration; bread, cheese, eggs, cooked and uncooked vegetables and fruits may remain fresh for months; all these are now possible with the help of atomic energy. Of the may uses of atomic energy, therefore, food preservation may prove the most beneficial. Its world wide results are expected to be as revoulutionary as the discovery, 150 years ago that food could be preserved by heat. Food is sterilised and preserved by exposing it briefly to atomic radiation given off by waste materials from atomic reactors or by radio isotopes or by specially designed machines. One method is to place the food in cans, freeze it and then expose the cans to radio-active materials placed at the bottom of a deep water pool. Another is to place food wrapped in cellophane on a conveyor belt that travels under a stream of atomic rays manufactured by an electron generator. Several different methods are being explored, each has its advantages for sterilising certain types of food.

The preservation of food by atomic radiation is not very different from preservation by heat. Both destroy bacteria and halt chemical changes that cause deterioration. Atomic preservation, however has some striking advantages. Heat sterilisation involves the use of high temperatures for at least an hour which alters the texture, taste and often the nutritive value of the food. Atomic sterilisation is a cold process completed in less than a minute, and does not alter the texture, taste or the nutritive value of the food. When perfected, atomic preservation will increase by atleast tenfold the length of time that foods can be safely stored without refrigeration. Tests have been conducted both on animals and man and the tests have been highly successful and promising, and have further shown that the foods maintain their full nutritive value. Many of the foods did not change colour, taste or odour, though a few were made less pleasing; it is expected to correct these difficulties. Atomic preservation will certainly benefit the world by saving millions of tons of food a year now lost by spoilage. It will reduce the need for fast transporatation and refrigeration, thus permitting shipment of food to longer distances at lower cost. More food at lower cost, equally distributed throughout all nations is possible. (A. H. S.)

Students' Corner

Tour of the second year Students: On the completion of the first terminal Examination, the students of the second year class proceeded on a short tour. The spirit and joy knew no bounds when they left the College Hostel on the 15th of September in two batches under the leadership of their lecturers. The wandering lust and the longing to learn outside the class rooms made every one of them eager and enthusiastic. The palm-fringed West Coast appealed to them and their visit to Mangalore, Pattambi, Taliparamba etc. gave them ample oppurtunity to learn a great deal about the cultivation of "dollar earning" crops as well as about the people and their way of living. They returned back to the College after a week's ramble, refreshed both in mind and body.

Meetings etc.: A General Body meeting of the students was held on 4th September with Dr. A. Mariakulandai, Vice President Students club in the chair. After briefly narrating the various activities of the club, the office bearers were introduced to the freshmen. After completing the business the meeting terminated with the vote of thanks by the acting Club Secretary Sri V. Rajaguru.

Sri R. R. Panjes' Address: Sri R. R. Panje, Sugarcane Botanist, Sugarcane Breeding Institute delivered an address under the auspices of the Students' Club on 6th October 1956. The topic was on his "Impression of Africa and some South East Asian Countries" and was illustrated with colour photographs and transparencies. Being an accomplished photographer himself, his illustrated lecture virtually transported the audience, to the banks of the Nile, to the pyramids of Egypt, to the dark thick jungles of Africa and to the temples of Thailand to behold the famous 150 foot long Buddha in repose. The speaker was introduced to the gathering by Dr. A. Mariakulandai, Vice-President of the Club who also took the chair.

Sri V. Rajaguru proposed the vote of thanks.

Debate in Tamil: Under the auspices of the Club a debate in tamil was held on the 19th October 1956. The proposition was "Construction for destruction". There were several participants among whom Sri C. Gopal was adjudged as the best speaker. Sri Velu and Sri T. S. Theetharappan were ranked second and third respectively. Sri C. Balasubramaniam, Sri Anandapadmanaban, and Sri Thandavarayan acted as judges. Sri G. Ramanathan proposed the vote of thanks.

Wild Life Week: A meeting was held on 8th October to celebrate the wild life week in the Freeman Hall, when Sri K. A. Boja Shetti, Conservator of Forests delivered an address. Sri Basheer Mohamad, Government Entomologist, presided over the function. The learned lecturer in the course of his address said that the valuable wild life is gradually becoming extinct on account of the changing conditions in the country, the encroachment of forest lands for agricultural purposes, cutting of forests for laying roads etc. At the close of his speech, the learned lecturer emphasised that wild animals should be given more protection and conserved. The meeting concluded with the proposal of a vote of thanks by the Secretary Sri V. Rajaguru.

Intercollegiate Debate: An Intercollegiate debate on the subject "Egypt is within her rights to take over Suez Canal and running it" was conducted by the Rotary club in the Mill Owners' Association Building. Sri S. Lakshminarayan and Sri G. Ramanathan represented our College.

In the Madras University debate conducted at the P. S. G. College of Technology Sri G. Ramanathan and Sri R. Krishnamurthy represented the college. The subject for the debate was "English should continue as the medium of instruction".

In an essay competition conducted by the local branch of the S. P. C. A. Sri U. S. Sriramulu won the first prize. This was organised in connection with the 3rd animal show.

A debate in all Regional languages, Viz. Tamil, Malayalam, and Kannadam was conducted in order to select a team of two to represent our college in the Madras University Debate. The subject for the debate was "English should continue as the medium of instruction". Sri A. H. Subramania Sarma presided over the function.

The President in his concluding remarks said that over 50% of the scientific journals of the world are published in the English language and added that a scientist has to know the English language if he has to contribute anything to the good of mankind.

The meeting came to an end with the vote of thanks by the Debating Society Secretary, Sri C. Gopal.

Inter Collegiate Drama: The drama "Sahati" was enacted in the Intercollegiate Drama competition conducted at the P. S. G. College of Technology on 9th November. Our College knocked off two coveted prizes in the intercollegiate drama. Among all the actors of the six Colleges who have participated in the drama, Mr. S. Sunderesan of the Second year class was awarded a cup for his performance as the best main actor and Mr. G. Ramanathan was adjudged as the best supporting actor for his performance as 'Greto' a friend of Sanatis and a cup was awarded to him. Sri Thangavelu, the Dramatic Society Secretary was congratulated by one and all on the success which was in no small measure due to his untiring efforts. (G. RAMANATHAN)

ERRATA

Vol. XLIII No. 10

Page 531 In the last sentence in the Paragraph following the Table 90% for 9%.

Page 521 In the last sentence of the Page, the words "C. C." to be omitted
Read: No. 8, 1954 for No. 8, 194

Page 515 line 9 from the bottom
Read: Resin, Hard water — Resin, Soft water

Weather Review — For October, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January	Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	6·1	— 5·9	34·0	South	Madurai	16·4	+ 9·0	34·6
	Tirurkuppam*	6·3	— 1·9	32·7		Pamban	3·8	— 4·7	6·1
	Vellore	7·1	+ 0·3	34·5		Koilpatti*	11·5	+ 5·8	22·5
	Gudiyatham*	8·2	+ 2·1	30·8		Palayamcottai	3.9	— 3·2	10·8
East Coast	Palur*	10·8	+ 2·6	37·7		Ambasamudram*	1·5	— 4·3	9·6
	Tindivanam*	8·2	— 1·7	33·0	West Coast	Trivandrum*	5·6	— 5·1	41·4
	Cuddalore	11·8	+ 0·3	32·5		Fort Cochin	19·9	+ 6·5	121·8
	Nagapattinam	7·4	— 3·2	21·6		Pattambi*	11·0	+ 1·8	82·9
	Aduthurai*	6·4	— 0·5	31·2		Kozhikode	16·8	+ 5·7	121·7
	Pattukottai*	6·6	+ 0·5	28·2		Taliparamba*	8·9	+ 0·1	131·5
Central	Salem	14·3	+ 7·9	36·5		Wynaad*	10·6	+ 1·2	75·5
	Coimbatore (A. M. O.)*	4·9	+ 0·8	14·2		Nileshwar*	£		
	Coimbatore	3·7	+ 2·6	12·9		Pilicode*	£		
	Tiruchirapalli	12·3	+ 6·0	27·9		Mangalore	9·9	+ 2·7	140·0
						Kankanady*	10·6	+ 3·7	143·5
						Kotekar*	11·2	+ 4·6	@
					Hills	Kodaikanal	13·5	+ 3·3	43·0
						Coonoor*	13·2	+ 5·3	32·1
						Ootacamund*	15·7	+ 6·5	39·2
						Nanjanad*	10·9	+ 2·3	43·2

Note:— 1. * Meteorological Stations of the Madras Agric. Dept.

2. @ = It is a new station. The raingauge was installed in March 1956.

3. £ Data are not received.

In the first three days of the month rains were fairly widespread in Tamilnad and in the West Coast. On 4—10—1956 the monsoon became active in the South East Arabian Sea and strengthened further the next day over the Laccadives and also over the South Bay of Bengal. Rainfall on these two days were fairly widespread in the West Coast and somewhat localised in Tamilnad. For six days from 6—10—1956 rainfall was fairly widespread in the West Coast and slightly localised in Tamilnad. The monsoon became active over the Comorin area on 11—10—1956. For two days from 12—10—1956 Tamilnad had localised showers while the West Coast had dry weather. But on 13—10—1956 conditions became favourable for the setting in of the North-east Monsoon over the east coast of the Peninsula and Tamilnad. On 14—10—1956 rainfall was widespread in Malabar and South Kanara while it was localised in Travancore-Cochin and at a few places in Tamilnad. For two days from 15—10—1956 rainfall was localised in the entire region. On 17—10—1956 the monsoon withdrew from north Hyderabad with the result that the weather was mainly dry with the exception of a few highly localised showers in Tamilnad. The South-west Monsoon withdrew from the country outside North-east India and the south Peninsula on 18—10—1956, while the conditions became favourable on the same day for the setting in of the North-east Monsoon along the east coast of the Peninsula. Only localised showers were received on 18—10—1956 and on the next day as well in Tamilnad and Malabar and South-Kanara while the weather elsewhere was mainly dry. The South-west monsoon withdrew from north Tamilnad on 20—10—1956, on which day thunder-showers were widespread in south Tamilnad and Malabar and South Kanara and fairly widespread in Travancore-Cochin and scattered in North Tamilnad. On 21—10—1956 the monsoon withdrew from

Malabar and South Kanara, as a result of which only Travancore-Cochin had fairly widespread rains while south Tamilnad had only localised showers. On 22—10—1956 only a few places in Travancore-Cochin had some showers while the weather was mainly dry elsewhere. The weather over the entire region was mainly dry on 23—10—1956, as the South-west monsoon withdrew completely from the region. For two days from 24—10—1956 showers were scattered at a few places in Tamilnad, while the rest of the region had only dry weather. On 26—10—1956 the North-east monsoon became active along the coastal Tamilnad, as a result of which showers were localised in Tamilnad and scattered in Travancore-Cochin while Malabar and South Kanara had only dry weather. The North-east monsoon extended into the interior districts of Tamilnad on 27—10—1956 and the rainfall was fairly widespread throughout. Rather a severe cyclonic storm formed in the South-west and adjoining south-east Bay of Bengal on 28—10—1956 and under its influence thunder showers were widespread in Malabar and South Kanara and localised in Tamilnad and elsewhere. It developed a small core of hurricane winds at 08-30 hours I. S. T. on 29—10—1956, about 200 miles South-east of Masulipatam and under its influence rains were widespread in Travancore-Cochin and localised in other places. In the subsequent two days this depression weakened and there were no large changes in the weather conditions.

Considering the month as a whole for Tamilnad, Salem, Tiruchirapalli, Mathurai, Nilgiris and to some exten. North Arcot and Coimbatore districts had fairly good rains. Conditions did not improve in Ramanathapuram district.

The noteworthy rainfall and the zonal rainfall in inches are furnished below:—

Noteworthy Rainfalls			Zonal Rainfall			
Date	Place	Rainfall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
4/10/56	Punalur	4·0	North	6·9	— 1·4	Below normal
5/10/56 & 15/10/56	Alleppey (Each day)	4·0	East Coast	8·5	— 0·3	Just below normal
12/10/56	Kallakurichi	4·0	Central	8·8	+ 4·3	Above normal
18/10/56	Tiruchirapalli	4·0	South	7·4	+ 0·5	Just above normal
26/10/56	Cuddalore	4·0	West Coast	11·6	+ 2·4	Above normal
29/10/56	Kozhikode	5·0	Hills	13·3	+ 4·4	do

Note: * Data from nine stations only are considered.

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 15—11—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Officers—Postings and Transfers.

Name and present post	Posted as
Sambandam, R., Asst. Cotton Specialist., Tirupur.	Gazetted Asst. to Cotton Certification Officer, Rajapalayam.
Krishnan, C. S., Gazetted Asst. to Cotton Certification Officer, Rajapalayam.	Reverted.
Murthy, P. A., Agrl. Eng. Supervisor, CBE.	Asst. Agrl. Engineer (Soil Cons. Scheme) Coonoor.
Sanjeeva Shetty, K. P., Asst. Agrl. Engineer, (Soil Cons. Scheme) Coonoor.	Asst. Agrl. Engineer, Kodaikanal.
Nagaraja Rao, K. R., Asst. Lect. in Entomology,	Asst. Entomologist, Coimbatore.

Upper Subordinates.

Name and present post	Posted as
Damodara Prabhu, M. (On leave)	Asst. Lect. in Agriculture, CBE.
Ganapathy, T. Instructor, Agrl. Exten. Training Centre, Bhavanisagar.	A. D. Ariyalur.
Jayaraj, M. V., A. D. Sivaganga	F. M. State Seed Farm, Sivakasi.
Narayana, K. M., (On leave)	F. M. State Seed Farm, Anayampatty and Ethapur.
Parthasarathy, K., Pongalur.	Asst. in Chemistry, Coimbatore.
Ramachandara Marar, P., A. D, Ariyalur.	Instructor, Agrl. Exten. Trading Centre, Bhavanisagar.
Radhakrishna Reddy, A., A. D. Vegetables, Madras.	P. A. to D. A. O. Guindy.
Ramanathan, R., F. M. Central Farm, CBE.	A. D. Vegetables, Madras.
Rangaswami, N. V., G. T. Madras.	A. D. Cheyyur.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE

CROPS
COTTON; GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

DEVOTED TO
A FACTUAL RECORD OF
SERVICE FOR REGULATED MARKETING

Review of Market Conditions of Commercial Crops in the areas of Market Committees for the Month of September 1956

I **Cotton:** (In this section: candy = 784 lb.; pothi = 280 lb.)

Cotton Stocks: Tirupur: Lint: The market had an opening balance of 6862 candies of Cambodia lint and 1554 candies of Karunganni lint. Arrivals totalled 5651 candies of Cambodia and 132 candies of Karunganni lint including that from ginneries. Despatches in the month accounted for 3805 candies of Cambodia and 648 candies of Karunganni lint which include 553 candies of lint sent to Tirunelvely, Orissa and T. C. State, leaving a closing stock of 8708 candies of Cambodia and 1038 candies of Karunganni lint at the end of the month.

Kapas: The kapas market opened with a stock of 12,593 pothis of Cambodia and 408 pothis of Karunganni kapas. Arrivals in the month amounted to 15,824 pothis of Cambodia and 1763 pothis of Karunganni kapas into this market, which include 4241 pothis of kapas received from Salem, Madurai, Villupuram, Tiruchirapalli and Tanjore. Disposals during the month amounted to 20,599 pothis of Cambodia and 1684 pothis of Karunganni kapas leaving a closing stock of 7818 pothis of Cambodia and 487 pothis of Karunganni kapas at the close of the month.

Koilpatti: Lint: The opening stock was poor at 73 candies of Karunganni lint. Arrivals amounted to 375 candies of lint from the surroundings areas of which 398 candies of Karunganni lint were disposed leaving a closing stock of 50 candies of lint at the end of the month. The Uganda market opened with a stock of 250 candies and 200 candies were received. A quantity of 350 candies were moved to Ramnad district for pressing, leaving a closing stock of 100 candies at the end of the month.

Kapas: There was no stock of Karunganni kapas here at the beginning of this month. The Uganda kapas market opened with a stock of 2500 pothis and 3000 pothis were received. Disposals totalled 4000 pothis leaving a closing stock of 1500 pothis at the end of the month.

In spite of the very low price offered by the mills as a result of the enhancement of excise duties announced by the Government of India, the prices continued to maintain a steady tone owing to limited stocks and also due to the reluctance of the producers to part with their produce.

Ramanathapuram: Lint: The three markets of this district Virudhunagar, Rajapalayam and Sathur opened with a stock of 1364 candies. Arrivals amounted to 2715 candies of lint while disposals accounted for 1370 candies leaving a closing stock of 2710 candies of lint.

Kapas: The kapas market in all these three places had an opening stock of 1950 pothis and 24300 pothis were received. Disposals amounted to 19800 pothis leaving a closing stock of 6450 pothis.

The trading in both lint and kapas in these markets was dull during the month on account of restricted arrivals. The harvests of Uganda cotton in Srivilliputhur area were restricted due to inclement weather.

South Arcot: Kapas: This market started with a stock of 9 pothis during the month. A quantity of 824 pothis was received during the month of which 783 pothis were despatched to Tirupur. The market closed with a stock of 50 pothis.

Prices: Tirupur: Lint: The market continued to be active during the month and the prices maintained a steady tone with quotations ranging from Rs. 920—970 per candy.

Kapas: The prices of Cambodia and Karunganni kapas were quoted at Rs. 131—135 and Rs. 111—121 respectively per pothi during the month.

Koilpatti Lint: The prices of Karunganni lint remained more or less steady during the month. The Market opened at Rs. 875—886 for the best quality and gradually advanced to Rs. 880—890 in the second week of the month. The prices remained steady for the rest of the month.

Uganda lint continued to be firm at Rs. 1025 for uncertified quality and at Rs. 1126 for the certified quality.

Kapas: The price of Uganda kapas remained steady at Rs. 130 to 140 per pothi of 280 lb. No transaction in Karunganni kapas took place during the month.

Ramanathapuram: Lint: The prices per candy for different varieties of lint at Viruthunagar Market were as follows:

		Opening	*Closing*
Karunganni	...	860/865	950
Tinny Karunganni	...	...	...
Tinny	...	770/820	777/830
M. U. 2. Uganda Certified	...	...	1152
M. U. 1. ,,	...	1101	1052/1086
Uncertified Uganda	...	1006	986

Kapas: The prices per pothi at Viruthunagar market are furnished below:

		Opening	*Closing*
Karunganni	...	$112\frac{1}{2}$ – $117\frac{1}{2}$	$112\frac{1}{2}$ – $113\frac{1}{4}$
Tinny ,,	...	$91\frac{1}{2}$ – $107\frac{1}{2}$	$91\frac{1}{2}$ – $110\frac{1}{2}$
Tinny	...	$77\frac{1}{2}$ – $90\frac{1}{2}$	$83\frac{1}{2}$ – 90
Uganda	...	$112\frac{1}{2}$ – $235\frac{1}{2}$	$116\frac{1}{2}$ – $136\frac{1}{2}$
Cambodia	...	75 – 109	75 – 115

There was a slight decline in the prices of kapas in general as a result of the inferior varieties of cotton moving into the market.

South Arcot: Kapas: The price of kapas in this district ranged higher during the month compared to the previous month and also to the corresponding month of previous year. The average prices ranged between Rs. 109/6 to Rs. 110/2 per pothi.

II. **Groundnuts:** (In this section: Candy = 531 lb.
Bag = 80 lb.)

South Arcot District: Stocks: All the markets of South Arcot District opened with a stock of 2891 tons of kernels at the begining of the month. Local arrivals amounted to 3612 tons and a quantity of 2090 tons was received from Coimbatore and Tiruchirapalli districts. Imports from Andhra State came to 372 tons. Consumption by power mills and country chekkus amounted to 4666 tons and 231 tons respectively. A quantity of 547 tons was moved to Madras, Tanjore, North Arcot, Chinglepet, Tiruchirapalli, Salem, Madurai and Ramnad while 18 tons were despatched to Pondichery and Andhra States. Wastage amounted to 589 tons. There was a closing stock of 2914 tons at the end of the month in this district.

With the conclusion of the harvest of summer crop, arrivals went down appreciably.

Prices: Larger arrivals of kernels and oil from other districts and low prices prevailing in Pollachi market had its repercussions in the markets of South Arcot district. The average prices for kernels ranged from Rs. 166/13 to 140/2 per candy in all the markets of the district.

North Arcot: Stocks: The market of this district had an opening stock of 818 ton of pods and 750 tons of kernels. Arrivals during the month amounted to 40 tons of pods and 98 tons of kernels while the off-take was 743 tons of pods and 693 tons of kernels leaving a closing stock of 105 tons of pods and 155 tons of kernels at the end of the month.

There has been an unsteady tone in the market of this district consequent on the reluctance of the big merchants and mill owners to trade in ground nut in the absence of any export quota and awaiting new winter crop arrivals. Imposition of additional cess also has caused the merchants to leave their transactions to the petty crushers.

Prices: The Prices of groundnut kernels as well as oils ruled steady during the first 2 or 3 weeks in the month. During the second fortnight the prices showed slight decline. The prices of kernels ranged at Rs. 143 to Rs. 170 per candy as aginst Rs. 95 to 105 that prevailed during the corresponding period of last year. The prices may change on receipts of new crop of groundnut.

Ramanathapuram District: Stocks: The market at Viruthunagar started with a stock of 500 tons of groundnut kernels at the commencement of the month. Arrivals amounted to 4100 tons during the month while 4600 tons of kernels were disposed off, leaving no stock.

The arrivals are largely from Pollachi area where the new crop season has commenced and crushing also is in progress in sizeable quantities.

Prices: The opening and closing prices of groundnut kernels during the month in this district are extracted below:

		Opening	Closing
Groundnut kernals	...	160/165	158/160

III. **Gingelly:** (In this section bag=168 lb.)

South Arcot district: Stocks: With the harvest of gingelly in progress arrivals improved considerably in Vridhachalam market. The market had an opening balance of 202 bags of Gingelly and arrivals totalled 3100 bags. Consumption by rotaries and chekkus amounted to 20 bags and 1054 bags respectively. Despatches during the month amounted to 1450 bags mostly to Tanjore, Tiruchirapalli and Ramnad districts leaving a closing stock of 778 bags at the end of the month.

Prices: The price of gingelly declined mildy in sympathy with the fall in the prices of groundnut seeds and oil coupled with the increased arrivals. The average prices in the several markets ranged from 65 — 71/8 per bag.

IV. **Coconuts and its products:** (In this section: candy = 700 lbs.)

Coconut Stocks: Manufacturing of copra was scarce and arrivals of coconut continued to be heavy due to the prevelance of monsoonic conditions in Malabar markets. In South Kanara, the coconut transactions continued to be weak throughout the period, with good stocks in the market. The arrivals and transactions in the market of Malabar and South Kanara districts are extracted below: (in 1000 nuts).

Centres	Opening Stock	Arrivals	Despatches	Closing Stock
Malabar:				
Kozhikode	7109	3400	3300	7209
Badagara	192	5500	4705	1687
Ponnani	330	675	685	320
Tellicherry & Dharmadam	449	1009	997	511
South Kanara:				
Mangalore	60	175	175	60

Prices: The prices of Coconuts in the above markets are quoted below:

Malabar: (Prices per 1000 husked nuts)

	Maximum	Minimum
Kozhikode	115	102
Ponnani	128	115
Badagara	136	80
Tellicherry & Dharmadam	98	90
South Kanara District (per 1000 nuts)		
Mangolore—Dry	180	135
Raw	140	145

Copra: Stocks: The arrivals of copra were poor during the month due to unfavorable weather for copra making. The transactions in the markets of Malabar and South Kanara Districts are detailed below:

Markets	Opening Stock	Arrivals	Disposals	Closing Stock
Malabar District: (in candy)				
Kozhikode	4123	5600	5750	4573
Badagara	995	1900	1795	1100
South Kanara: (in tons)				
Mangalore	107	425	425	107

Prices: The prices of copra per candy in Malabar District were as follows: (in Rs.)

Variety	*Kozhikode* Maximum.	*Kozhikode* Minimum.	*Badagara* Maximum.	*Badagara* Minimum.
Office	295	290	315	300
Edible	312	310	No Stock	
Madras	305	302	325	318
Rajapur	335	330	345	320

The prices of copra in Mangalore market ranged between Rs. 300 to 325/-

V. **Arecanuts:** (in this section Bag = 100 lbs.)

Stocks: The arrivals and transactions of arecanut in Malabar and South Kanara Districts are extracted below:

	Opening Stock	Arrivals	Disposals	Closing Stock
Malabar District:				
Kozhikode (in bags)	816	5447	4003	2260
South Kanara District:				
Mangalore (in cwt.)	5412	9200	9200	5412

Prices: There was a slight fall in the price in the beginning of the month which remained steady during the latter part of the month in South Kanara District. Prices showed an upward trend in Malabar District.

The prices of arecanuts in the markets of Malabar and South Kanara Districts are extracted below:

	Maximum. in Rs.	Minimum. in Rs.
Malabar District:		
Kozhikode (per bag)	200	185
South Kanara District: (per cwt.)		
Koka	125	95
Choll	189	165
Malabar Supari	No Stock	—
Mangalore Supari	do.	—

VI. **Tobacco:** (In this section Candy = 500 lbs.)

Stocks: (Coimbatore) The Tirupur market started with an opening stock of 23,340 candies of chewing and 2200 candies of cheroot tobacco at the commencement of the month. About 6050 candies of chewing and 1880 candies of cheroot tobacco were despatched during the month to places in Palghat, Illupur, Elayangudi, Pandukudi, Alleppy, Trichur, Malabar, Tiruchirappalli, Tanjore, Salem, Dindigul, Pudukottai, Chinglepet, Madras, Mysore and Andhra. About 25 candies of chewing tobacco from Madura and 50 candies of beedi tobacco are reported to have been obtained in the district. At the end of the month there was a closing stock of 20,055 candies of chewing and 1180 candies of cheroot tobacco.

Prices: The prices of different varieties of Tobacco per candy in Tirupur market are given below. A general decline in the prices was noticed due to lack of demand.

Variety	*I Grade* Rs.	*II Grade* Rs.	*III Grade* Rs.
1. *Chewing tobacco—Sun cured.*			
a. Meenampalayam	300 — 400	200 — 300	100 — 180
b. Other varieties	200 — 250	115 — 160	70 — 90
2. *Cheroot varieties:*			
Sun cured (grown in Erode and Bhavani)	210 — 310	155 — 205	100 — 145
3. *Chewing varieties:*			
Pit cured (grown in Palladam and Sulur areas)	250 — 340	125 — 200	90 — 125

Review of the administrative activities of the Market Committees for September 1956

General: All the Market Committees continued to function under Section 6 (A) of the Madras Commercial Crops Markets Act except Coimbatore Market Committee and Malabar Market Committee which are functioning under an elected body. The stalemate caused in the Market Committees of Tirunelveli and Ramanathapuram still continues awaiting the judgment of the Supreme Court.

The following is the progress made in the issue of licences by the Market Committees in the State :

	Section 5 (1)		Section 5 (3)		Weighmen	
	A	B	A	B	A	B
North Arcot Market Committee	129	1188	44	685	36	421
South Arcot Market Committee	166	1892	134	1597	119	1472
Coimbatore Market Committee	47	841	49	892	23	596
Tirunelveli Market Committee	Nil	13	Nil	16	Nil	7
Ramanathapuram Market Committee	Nil	29	Nil	28	Nil	5
South Kanara Market Committee	35	181	7	69	—	57
Malabar Market Committee	33	399	105	1498	49	367

A : During the month. B : Upto end of the month from January 1956.

Meetings: A Meeting of the Malabar Market Committee was held on 29-9-56. The Committee decided to celebrate the Regulated Markets Service Week at Kozhikode and Thalakadathur for 4 days in February 1957. The Committee also decided to investigate the possibilities of opening of Regulated Markets at Changaramkulam and Parapuzha in Ponnani Taluk.

Quality Appraisal: The South Arcot Market Committee continued its work on the quality analysis of Groundnut kernels marketed in that district. During the month 127 samples were drawn and analysed from out of 2577 lots comprised of 15,362 bags of kernels. Total common refraction was below 4% in 99 samples, 5 to 8% in 28 samples and above 8% in no samples. All the samples at Vridhachalam contained moisture below 4% while most of the samples at Cuddalore and Panruti contained moisture between 6 and 10% respectively. Thus the crop marketed at Cuddalore was bad and that marketed at Panruti worse during the month.

Quality Competition: The South Arcot Market Committee secured 203 entries during the month for the summer crop quality competition.

The inauguration of the Regulated Market at Arni by the Hon'ble Minister for Revenue Sri M. A. Manickavelu.

The inauguration of the Regulated Market at Arcot by the Hon'ble Minister for Agriculture Sri M. Bhakthavatsalam.

General: The Regulated Markets Service Week was celebrated at Villupuram from 10th to 15th September 1956. An exhibition depicting the activities of the regulated market was put up at the Villupuram Market Yard on the occasion. A meeting was convened on every day when lectures on various marketing aspects were delivered. On the last day the Director of Agriculture awarded prizes to the winners in the quality competition.

North Arcot Market Committee

Two new Regulated Markets were opened during October 1956 in the North Arcot district, the first at Arni and the second at Arcot. The first at Arni was inaugurated on the 2nd October by the Revenue Minister Sri. M. A. Manickavelu, B. A. B. L.. in a delightful function which was largely attended. The Hon'ble Minister in the course of his address stressed on the useful role of the Regulated Markets and emphasised that these markets are for the mutual benefit of both growers and traders. He exhorted them therefore, to make full use of the markets opened by the North Arcot Market Committee.

The Regulated Market at Arcot was inaugurated on 8th October, 1956, in another pleasant function by the Hon'ble Minister for Agriculture, Sri. M. Bhakthavatsalam, B. A. B. L. A large gathering of officials, growers and traders was present. In his address, the Hon'ble Minister outlined the benefits conferred on growers and traders by the Regulated markets. He added that these markets helped the growers to get the best prices for their agricultural produce and if they do not get that, the growers would not, in many cases meet even their cost of cultivation and thereby they would loose interest in growing commercial crops. The Minister went on to say that the growers should be encouraged by the traders to get their due share which in turn meant that they would grow more and more for the benefit of both. In concluding, he wished the market all success and then declared the Regulated market open. The function was presided by Sri. S. Panchaksharam Chettiar, M. L. A., President of the District Congress Committee.

THE MADRAS AGRICULTURAL JOURNAL

Hints to Contributors

The pages of the Madras Agricultural Journal shall be open ordinarily only to the members of the Madras Agricultural Students' Union.

All articles for publication should be addressed to the Editor, Madras Agricultural Journal, Lawley Road P. O., Coimbatore.

In view of the high cost of printing, contributions should be as concise as possible and should conform to the best usage in the leading Journals published in India and abroad.

Manuscripts should be typed with double spacing on one side of the paper only and with wide margin. They should not ordinarily exceed 5,000 words or 12 pages of printed matter including tables and illustrations in the Journal. Manuscripts should be carefully revised; numerical data and calculation checked. Main headings in the text should be typed in capitals with paragraph indentations and followed by a period and two hyphens. Sub-heads should be lower case and be underlined to indicate italics. Latin nomenclature and local terms etc., should be in italics. Original papers must conclude with a summary of not more than 300 words, drawing attention to the main facts and conclusions.

Tables: The number of tables should be restricted to those absolutely necessary, as numerous tables detract from the readability of the article. Each table should be numbered consecutively from 1 up and must have a heading stating its contents clearly and concisely. The tables are to be typed on separate sheets with their positions marked in the text.

Illustrations: Wherever possible illustrations should be made with pen and Indian ink for reproduction as line blocks. The name of the author, title of the article and figure number should be written on the back of each figure in blacklead pencil. Each figure should have a legend typed on a separate sheet.

Photographs: Photographs and wash drawings are more expensive as half-tone blocks are necessary. The cost of blocks is chargeable to the author of the article. Photographs submitted as illustrations should be unmounted, glossy prints of good quality, with strong contrasts, trimmed so as to include only the essential features to be illustrated. They should preferably be of the same size as desired in the printed paper. Photographs should always be packed flat, never rolled or folded.

Line drawings: Line drawings, and charts should be prepared in twice the scale desired in the printed form. All letterings, figure numbers and explanatory notes in graphs should be light face and large enough to be 1/16" high in the finished illustrations.

Graphs: Graphs should be drawn in Indian ink on co-ordinate paper ruled with blue lines. Any portion which is desired to appear in the reproduction should be drawn over with Indian ink.

References: References and reviews of literature should relate only to closely pertinent papers. The list of references should come at the end of the article, after the summary and should be arranged in alphabetical order of authors' names followed by the year of publication in brackets, and then the title of the paper, name of periodical, volume number in bold face type and then the page number, e. g. Darlingtion C. D., (1944) Heredity, development and infectione *Nature*, **154**; 164-9. Abbreviations for names of journals are to be in the approved form as given in the World List of Periodicals.

The responsibility for statements, whether of fact or opinion, rests entirely with the author of the article and not with the Editorial Board of the Madras Agricultural Journal.

The Madras Agricultural Journal

Vol. XLIII December 1956 No. 12

Editorial

When this issue of the Journal reaches our readers, our farmers would be busy preparing for a grand celebration of the *Pongal* and *Mattupongal*. The coincidence of the harvest festival with the cattle festival is of unique significance in that it connotes the inseparability of cattle from Indian agriculture. They are essential for the provision of draught, milk and manure. The contribution of livestock to the national income was estimated sometime ago at 663 crores and when the contribution in the form of draught and manure is added, the income exceeds 1300 crores.

We are unfortunately attempting to maintain an excessive number of cattle as their productivity is acceptedly poor. Indeed, it is a vicious circle, in that low productivity necessitates maintenance of a larger number, which in turn is poorly maintained resulting in further deterioration. In any programme of maximising agricultural production, the role of cattle and their improvement, loom large. It is therefore pertinent that a variety of measures are being adopted to attain rapid improvement, the most important being the Key village scheme. The distribution of pedigreed bulls and the grading up of the scrub stock in earlier years did not achieve the desired end because, the use of the superior bulls was not persisted generation after generation, with the result any improvement that was brought about was nullified by the use of inferior bulls subsequently and the quality of the stock therefore reverted to the initial scrub levels. The Key village scheme is a co-ordinated effort to get over some of these drawbacks of earlier years.

No improvement of our cattle can be permanently sustained without simultaneous adoption of better feeding standards. It is notorious that the nutrient requirements of our cattle are inadequate both in quantity and quality. In a recent survey by the nutritional committee of the Indian Council of Agricultural Research, the fodder requirements were estimated at 932 million tons and concentrates at 40·28 millions tons as against which, the available supply was only

798 million tons of fodder and 13·76 million tons of concentrates; thus leaving a wide gap between requirement and availability. In respect of quality, the fodders are very coarse with wide nutritive ratios as quite a large portion of the supply is constituted by mature straws after production of grain. The quality of the concentrates is also equally poor as rice bran constitutes the major source. In regard to grazing, pastures are very poor and badly maintained due to indiscriminate grazing, indeed they are more exercise grounds for the cattle than otherwise.

It is in this background that we have to plan for more fodder and feeds for our cattle. Efforts directed at present to grow more food may simultaneously increase straw yields as well, but again the quality factor is there. The extension of cultivation of other fodder grasses and crops like guinea grass and lucerne is already in our propaganda programme. Pasture improvement is being earnestly considered. It is a matter for serious thought whether some of the tubers like turnips, mangolds and others commonly fed to cattle of the temperate regions cannot be fitted in our agronomy. We have also some indigenous tubers like tapioca and sweet potatoes with high digestibility coefficients and very high calorie output per acre. A supplementary feeding with these tubers may go a long way to offset the handicaps of a straw feed.

If our cattle are poor, our buffaloes are equally so. Yet buffaloes play an important part in the milk supply of the country. Over fifty per cent of the milk production is from buffaloes. As a producer of high quality milk, rich in fat and total solids and as a consumer of very coarse straws, with no preferences and no exclusions, the buffalo is the most economical milk producer in the world. It is time that the buffalo receives as much attention as the cow in the country's economy.

All these considered the *Mattu Pongal* is an important festival for the farmer and it is an occasion when he should, every year, pledge to the better feeding, management and improvement of his bovine stock. It is most opportune, therefore, that the Government of India have instituted a scheme for the award of the title of " Gopal Ratna " to the owners of the highest milk yielding cows and buffaloes of certain breeds in an All India Milk Yield Competition. This incentive will really go a long way in improving the care and maintenance of the milk herd of the country.

Breeding Kangayam Cattle in Madras State

by

Lt. Col. T. MURARI, B. Sc. (Oxon), F. L. S., F. R. S. A., A. I. R. O.
Director of Animal Husbandry, Andhra

The Kangayam Cattle: The Kangayam breed of cattle has its home in Coimbatore District extending from Dharapuram Taluk to Palni Taluk of Madurai District. They have many characteristics in common with Mysore cattle (Olver 1938) and an admixture of the blood of Ongole cattle (Phillips 1944). The purity of the breed is being maintained by the well known cattle breeder, the Pattagar of Palayakottai, whose forefathers dedicated themselves to rear this breed. Even today the finest specimens are to be found in the herd of the Pattagar.

With a view to preserve the breed and to spread it for work purposes in some of the Southern districts, the Livestock Section while under the Agricultural Departmsnt started breeding Kangayam cattle in 1925. Inspite of the fact that breeding of these cattle has been maintained for nearly 30 years by the Agricultural and later by the Animal Husbandry Department, it depends on the herd of Pattagar of Palayakottai for fresh blood.

The Kangayam is a very fine draught animal suitable for ploughing and cart work. It is hardy and capable of fast work, though it is only second in the matter of speed when compared to Hallikars or Amrat Mahals. The Kangayam though not a milch breed gives more milk than any other breed comprising the Mysore group of cattle. Indeed the Pattagar of Palayakottai had been doing a fair amount of trade in liquid milk especially since the last war when the demand for the same increased.

Recognising the possibilities of improving the milch quality of the Kangayam, experiments were started both by the Animal Husbandry Department and under the auspices of the Indian Council of Agricultural Research, New Delhi.

As the Pattagar keeps the herd under ranch conditions the cattle are usually wild. Their pointed horns with their upward growth can make them exceedingly dangerous to men and cattle. The herd in its home tract has for its grazing, rich pastures of Kolukattai grass *(Pennisetum cenchroides)* which is rich in protein, calcium and phosphate. The climate is hot and dry in summer

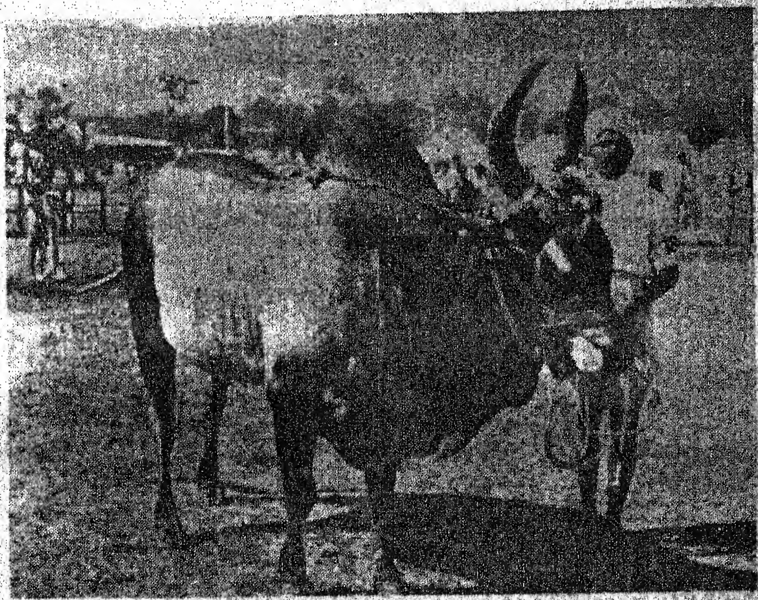
and moderate in winter months with a low rainfall of about 15 to 20″. Inspite of this low rainfall, the grazing is generally sufficient.

The farm is run on a feudal system and the Pattagar evolved it in such a way that it continues to work well even today. His tenants who not only look after their own lands also provide the labour for running the Pattagar's farm. The Pattagar's bulls serve all the cows of the tenants and the calves are selected from the progeny which is always under his observation. He is also able to see which of his bulls are good and prepotent. In view of the fact that selection is mainly for producing good work bullocks it is easier for assessing the value of the stock. Once a year young bulls are picked up for training and are tethered for the first time for feeding and handling them before being sent to the market. This period of training usually takes about 3 to 6 months. It is during this period that concentrates like pulses and pods from the white babul are fed to the young bulls. The soil rich with lime - producing pasture like *Kolukkattai* and *Indigofera* contribute much to the success of herd management. Such of the animals that do not come to the high standard of excellence are culled out. Taking a very rough estimate about 30% of the young stock are culled out periodically.

At a time when the Alambadi and the Mysore breeds were spreading fast in the area, in order to save and preserve the Kangayam breed, Mr. R. W. Littlewood, the then Livestock Expert with the Madras Government decided to breed Kangayam at the newly acquired farm at Hosur. The farm is about 3000 feet above sea level on the Mysore plateau with a dry, mild climate and moderate rainfall of about 30 inches annually.

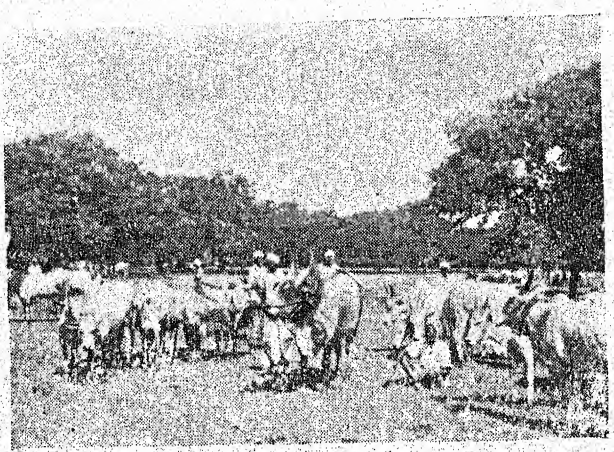
The foundation stock were purchased in 1925 and 1928 from the Pattagar. The farm at Hosur is over 1650 acres with large paddocks for grazing. The Kangayams were so wild in the beginning that it was difficult to control them. Very often when folded at nights with about a 6 foot wall enclosing them all around the whole herd could jump out of the enclosure and stray far out in search of grazing. At the time they were all purchased they were in good condition, robust, active and very alert.

Physical Characteristics: Two varieties are recognised in the breed - one large and the other small. The body is compact with short legs. They are white in color, the males showing deep grey



Kangayam Bull, Prize winner at Delhi Show.

Kangayams—good milkers.
(Livestock Research Station, Hosur.)



Bull and his progeny,
(Milch strain)

Bull and his progeny.

with black shades on the head, neck, hump and quarters. The horns are symmetrical and grow upwards, outwards and backwards. The eyes have black rings of skin around them. The neck is short and thick and the dewlap is thin and extends only upto the sternum. The barrel is compact and well ribbed. The sheath is well tucked up. The quarters are slightly drooping. The hooves are strong and compact, and locomotion is even and balanced.

(1) *Coat Color:* One of the earliest observations made with the Kangayam is the color changes during the animal's life. Kangayam calves are light brown in colour at the time of birth. As they grow older the coat colour gradually changes to light grey before they are one year old. By the time they are 2 to 2½ years old, the females continue to be light in colour and the bulls develop iron grey shades on their shoulder and hump. Black markings almost like broad, black bands appear on the pasterns. In the females, after they are about 2 years old and advances towards maturity the grey colour gradually fades and they become pure white. When cows have severe attack of Foot and Mouth disease, probably due to some change in the internal metabolism the coat colour changes to grey and remains so throughout life.

Coat color was studied in a progeny of 244 animals born at the farm out of which 135 were males and 109 were females. The coat colour of the progeny are tabulated below. All the sires of the progeny were dark grey, with black shades on face, neck, hump and quarters except Sire No. 391, which though a dark grey had light iron shades on head, hump and extremities.

TABLE 1

Coat Color Inheritance among Kangayams

Male			Female		
Dark grey with black shades on hump, neck and extremities	Light grey with dark shades on hump, neck and extremities	Dark grey with patches on dewlap	Black	Grey with black rings on fetlock, coronet	Light grey
99	25	10	1	92	17

Taking the Kangayams as a herd there is differentiation in coat color inheritance according to sex. Among the females the general colour is grey with dark shades on knee, fetlock and coronet and there are light greys. In the case of males the dominant colour

is dark grey. Out of 135 bulls observed in the farm, 99 were dark grey and they had dark shades over the head, neck and extremities. The dark greys which had white patches totalled 10, and white patches are considered as a fault in the breed. In order to produce a uniform coat color, it would be better to cross deep dark grey bulls with pure grey females.

The colour of the skin in the Kangayam is black. The muzzle is also black pigmented and tongue is bluish black.

(2) *Horns:* From the aesthetic point of view and the value of the animal, the shape, symmetry, thickness or fineness of the horn and the direction of their growth are factors in selecting a bullock. To the animal the horns serve as a weapon in defence. It is interesting to note that, as a rule, the female stock have shapely and fine pointed horns. Animals being very short of temper fight with each other often. From the practical point of view for management, work, milking or fattening it would be a good thing to poll the animal, the only disadvantage being that under local conditions it would be difficult to get a good price for an animal without shapely horns. Shape and size of horns were studied among 169 animals including both males and females and the observations are given below:

TABLE 2

Size and Shape of Horns

Narrow, thin, and divergent		Thick, slightly wide		Medium size curving inwards		Long and curving inwards	
MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
2	9	27	13	33	34	23	28

All the animals were divided into four classes according to the shape and size of horns as shown in table No. 2, which brought out the fact that males have thicker, stumpy and shorter horns, whereas the females have long, and fine horns. But it will be seen that there is much variation in the size, shape and direction of growth of horns. Though much trouble is usually taken to study aspects such as this, in the case of Kangayam it is found that as the animal grows older, the horns grow longer and the shape and sweep of the horns may become different from what is noted at an early age. So selection before the animals are 2 years old becomes very difficult ... of marketing.

In view of these variations culling for horns alone if practised, would be high and this is what the Pattagar of Palayakottai does with his herd. If however the importance of horn characteristic is eliminated and take the animal only from point of view of its work characteristic and ability, then there would be no need for culling at all. From a practical point of view dehorning could be advocated with advantage.

(3) *Sheath and Looseness of Skin:* The naval flap in the females and the sheath in the males are usually prominent in the Indian milch breeds like the Sahiwal, Ongole etc., but not so prominent in the Indian work breeds like the Amrat Mahal and Hallikar. In the Kangayam also these are not prominent. It was however noticed that when breeding for milk they become prominent particularly in the case of the sheath in the bulls. In bulls the sheath tends to hang down instead of being tucked up to the belly. A sheath that hangs down thus is considered a fault. But it has to be remembered that when bred for developing the milk characteristic, the skin on the body tends to become loose and mellow, and even among males this is evident. If a male is found to have a loose and mellow skin we may say it is born of a dam which was a good yielder.

A random number of 60 bulls were classified into groups according to the milk yield of their dams. As the Kangayam is not a milch breed dams that have yielded over 2000 lb. per lactation were classified as heavy yielders and the rest as purely possessing the work characteristic. The looseness of the skin and the sheath were studied in these animals, Among a total of 21 animals whose dams yielded more than 2000 lb., 18 bulls (86%) had loose skin and loose sheaths and only 3 (14%) had light skin and tight sheaths. Among 39 bulls, whose dams yielded less than 2000 lb. 10 had loose skins and loose sheaths (26%) whereas the rest 29 (74%) had light skin and tight sheaths.

The total number of 85 males and 109 females were studied for this physical characteristic. Among the males 41 had tails reaching the level of the hock and 44 reaching well below level of the hock and the occurrence is 50: 55; whereas in the females 70 had shorter tails and 39 with tails reaching well below level of hock, there being a 2 to 1 chance of the female having a shorter tail reaching the level of the hock.

(5) *Hoof:* The Kangayam has usually good and well made hooves. There is however a tendency to have curved in hooves and with wider space in the cleft among some of the animals, whose progeny have to be watched,

TABLE 3

Physical Measurements of Kangayams

Item		Average weight (lbs.)	Average height (inches)	Average Length (inches)	Average girth (inches)
At birth	..	43·9			
1 month	..	59·4	28·3	24·4	26·3
2 months	..	89·3	31·3	28·7	31·0
3 months	..	118·6	34·3	31·5	34·2
4 months	..	150·7	36·6	33·8	37·6
5 months	..	180·6	38·3	36·2	39·9
6 months	..	201·9	39·8	39·1	41·8
Adults:	Males:	1268·7			
	Females:	774·7			

Milk Production: The milk yield is poor. But there are some good milkers. It was decided to evolve a milk strain among the Kangayam without impairing their working capacity. The average milkers for the breed were kept for maintaining the herd and bred with bulls from the Pattagar's herd.

The average yields for the foundation cows as recorded by Mr. R. W. Littleword are given below :—

Average Milk Yield ... ... 1493 lbs.

Daily average yield ... ... 6·2 lbs.

For the farm breds, he gives the following figures :—

Average milk yield ... ... 1515 lbs.

Daily average ... ... 6·6 ,, (224 days lactation period)

Highest yield recorded ... ... 4105 lbs.

Daily average ... ... 10·9 ,,

The highest milk yields among Kangayam as recorded by Mr. R. W. Littlewood are compared below with the farm bred at Hosur (1949—50) and those bred at Palayakottai (1950—51.)

TABLE 4

HOSUR CATTLE FARM R. W. Littlewood (1936)		HOSUR CATTLE FARM (1949—50)			PALAYAKOTTAI Cows other than the scheme (1950—51)		
Average milk yield (lbs.)	Daily average (lbs.)	Average milk yield (lbs.)	Daily average (lbs.)	Days in milk	Average milk yield (lbs.)	Daily average (lbs.)	Days in milk
3074	8·8	4173·5	13·9	301	3110	8·2	381
2238	8·7	4057·0	14·4	281	3440	9·3	371
2742	9·5	3148·0	12 9	244	3813	12·9	297
2683	8·7	2822·0	10·1	267	3787	9·7	382
2811	9·3	2426·5	9·8	248	3183	7·8	409
2747	9·3	2409·0	8·4	288	3127	7·4	423
3471	11·4				3281	9·2	358
2143	7·7				3109	9·9	313
3071	9·3				3334	6·8	493
2373	8·1				3202	8·9	361
2552	7·3						
2104	6·7						
2073	7·8						
2338	8·9						
3163	9·5						
2450	16·9						
2585	10·2						

Despite over 28 years of breeding work among the Kangayams, by selection for both milk and work the results have not been striking. Comparing the latest figures from the work that is being done at Palayakottai itself it is seen that from the general herd the differences are very little.

The general observations on the results obtained at Hosur may be summarised as follows. The Kangayam herd as a whole at Hosur does not show the same quality as that at Palayakottai. The male stock at Hosur are of a much lower standard than those at Palayakottai. The reason for this is that at a breeding station it was not possible to cull as rigidly as the Pattagar could do at his commercial farm. On the one hand it is important to assess the potentialities of the breed and its weakness. On the other the difference in the environment and management, which is not always constant.

In the Kangayam, great importance is placed on the shape of the horns in breeding. It is a curious fact that while the female stock show a better set of horns, the male stock do not and thus their market value is lowered. The differences in the milk and work strains has become fairly marked and can be easily noticed by the practical breeder. Male and female stock alike generally possess mellow and loose skins if they belong to the milk strain as is the case in all the milch breeds of this country. A tendency in the conformation towards the wedge shape among cows and bulls becoming paunchy, with mellow skin and loose sheath, is observed.

The quality of animals produced outside Coimbatore District is not as high as that produced by the Pattagar. Though the parent herd at Hosur was from the Pattagar herd and though there has been frequent infusion of blood from his herd, the high quality of the bulls obtained at Palayakottai, has not been attained.

Average Milk yield and dry period of a random sample of 50 Kangayam Cows are given below :—

TABLE 5

Average Milk Yield of a Random Sample of 50 Kangayam Cows

Serial No.	Cow No.	Average milk yield (lbs.)	Daily Average (lbs.)	Dry period – average (days)
1	394	1186·6	4·6	278·5
2	379	1365·3	5·3	192·5
3	381	1494·0	5·6	188·0
4	382	1021·3	4·1	178·3
5	384	1186·7	4·6	291·4
6	388	1120·7	4·4	182·0
7	389	1262·2	6·1	141·0
8	390	2148·1	7·3	142·5
9	392	1020·6	4·4	289·6
10	365	1353·5	5·4	182·0
11	366	2124·5	8·4	106·0
12	367	1684·3	6·5	166·0
13	373	1377·6	5·1	179·4
14	377	1414·8	5·36	199·2
15	378	1550·2	6·1	189·0
16	352	1567·0	5·76	138·8
17	357	1376·5	5·5	201·6
18	359	1580 0	5·7	134·5
19	360	1474·4	5·8	310·2
20	361	1807·1	7·1	173·0
21	363	1126·0	5·1	334·5
22	242	1155·6	4·4	232·4
23	243	1667·4	6·2	158·1

TABLE 5 (*Contd.*)

24	345	1444·2	6·6	179·9
25	346	1159	4·3	278·5
26	347	1314·8	5·2	152·7
27	349	1926·6	6·91	192·0
28	331	1364·4	5·25	156·0
29	332	1073·5	4·0	150·8
30	334	929	3·7	196·3
31	340	1551·1	6·1	118·5
32	341	1246·8	5·4	253·2
33	309	1272·3	5·2	141·6
34	310	1311·8	4·6	199·8
35	311	1439·5	4·8	134·0
36	312	1094·5	4·2	157·6
37	313	1273·6	5·3	194.0
38	318	2360·6	7·0	302·0
39	319	1348·1	5·6	216·0
40	321	1340·9	5·7	388·7
41	322	1291·9	4·8	244·2
42	325	1960·4	6·9	144·6
43	326	1719·7	6·3	240·3
44	295	1654·3	6·1	113·7
45	297	1689·6	5 9	252·2
46	301	682·0	5·3	152·0
47	302	1327·0	4·9	211·3
48	303	1355·5	5·1	111·0
49	305	1352·6	5·5	342·8
50	307	2381·7	7·35	77·6
Average:		1440	5·57	198·1

The quality of Milk: Some tests were made at the Livestock Research Station, Hosur for comparing the quality of butter and ghee made from various breeds. The fat percent varies from 3·5 to 5%. The grain and the colour of butter were only second to those of the butter from Scindhi, but for aroma and the keeping quality of ghee, Kangayam comes first.

Defects: *(1) Locomotion:* The Kangayam breed is purely meant for work and hence in locomotion it is essential that the movements of the animal are easy and well balanced. Easy movements are as important in a work bullock as in a race horse. When the movements are well balanced the work done is more efficient and less tiresome to the animal. In the case of the Kangayam there is one defect that needs urgent attention. In a large number of animals the forelegs tend to cross over and in pronounced cases there is brushing between the legs. It is curious

rate of growth and shape of certain bones. To get the forelegs a little apart depends on the development of the brisket and with a wider angle the forelimbs will reach the ground a little wide apart. The urgent need for correcting this defect is brought out by the observations summarised below:

TABLE 6

Locomotion of the Forelimb in Kangayam Animals

No. of the Farm Stud Bull	No. of adult animals examined	No. which appeared normal in locomotion	No. of which showed defects locomotion
554 (Pattagar's)	42	9	33
555 do.	27	6	21
391 (Farm bred)	37	8	29
269 do.	17	7	10
506 do.	13	6	7
531 do.	15	5	10

The author had been selecting bulls for better locomotion and he had also brought to the notice of the Pattagar of the Palayakottai the particular defect in locomotion of some of his animals. Steps were being taken to correct this defect.

Blindness: There were only two cases where calves were born blind. During the drought period which lasted for over 5 years the Pattagar's herd went through great hardships. As there was no green fodder available the herd developed night blindness due to lack of vitamin A in the fodder, but when conditions improved the defect disappeared.

Longevity: The Kangayam breeding tract has low rainfall and frequent spells of drought are common in the tract. The Kangayam is a hardy breed and in the summer months when the grazing herbage is dry the Kangayam actually looks better than other herds under similar conditions.

From the economic point of view longevity is important. The Kangayams are known for their prolonged usefulness both as breeding stock and as draught animals. The Kangayam cows are regular breeders producing even upto 12 or more calves during their life time.

Utility of the Breed: The Kangayams are a hardy type of animals, but will not stand low temperatures, and their coat changes to keep their normal temperature; they are hardy under ranch conditions and they breed well. The prominent hump tends to get smaller when grazing is scarce. For cart work, ploughing and

lifting water from wells the Kangayams are very good. As they are not as heavy as the Ongoles, they are faster in work. On the whole it is a very useful animal for general purpose to the ryot in rural areas.

Herd instinct: The herd instinct is strongly developed in Kangayam. The author has known animals that have travelled over 20 miles to return to their parent herd. In case of danger they have a keen instinct to herd together.

Summary: This work is purely a sum total of the observations made by the author during the long period of his association with the Kangayam breed at the Hosur Cattle Farm. Coat colour, shape of horns and skin structure in the breed and their inheritance were studied in a group of animals at the Hosur Cattle Farm and the results have been recorded. Though it is hard to generalise and to come to any definite conclusions on any one particular characteristic of the breed, one important aspect stands out clearly. That is the defect in the conformation of the forelimbs and its effect in locomotion. This needs early elimination by study and selective breeding.

Acknowledgments: The herd has had Superintendents and Managers who were in charge of this breed. The two officers who were in touch with the breed for the longest period of time were Mr. R. W. Littlewood and the author. Mention should be made of Mr. K. T. Benjamin, who handled the dairy herd and of Sri K. Kandaswamy Raju, who handled the rest of the herd and for collection of information under the author's direction. My thanks are due to them for their assistance. My personal appreciation of the excellent work done, by Fieldman late Thayappan and Fieldmen Sabjan and Venkanna, which has contributed to the success of the Hosur Cattle Farm, in breeding livestock is recorded here. My thanks are also due to Dr. Pattabiraman for his work with the Kangayam breed at Palyakottai.

REFERENCES:

Certain Agronomic Practices Contributing to Higher Yield in Rice

by
A. ABDUL SAMAD, J. CHANDRAMOHAN,
and
P. K. VIJAYAN,

Introduction: Of late, in an effort to attain self sufficiency in rice production in our State there have been various attempts to explore the possibilities of increasing the acre yield by adopting Japanese and other improved methods of rice cultivation. Trials have been conducted in various Research centres in India to assess the exact contribution of some of these methods like planting in lines and giving wider spacing between plants, intercultivation with intercultivators or working weeders between rows of standing crop, heavy application of manures like cattle manure, compost or green leaf and fertilizers like ammonium sulphate and super phosphate. In this paper the results of trials conducted at the Agricultural Research Station, Pattambi, Malabar with special reference to some of these aspects are reviewed.

Materials and methods: Four different observations as indicated below were made to assess the exact contribution of the above factors in the shape of experiments and observation plots.

(1) An experiment to 'Compare the merits of the Japanese method and the Farm method,' was laid out during the cropping seasons of 1953, 1954 and 1955. The main features of Japanese method are: (1) raised nursery beds in long and narrow strips to facilitate weeding, (2) manuring the seed bed with cattle manure at 40 cart loads plus wood ash at 2,000 lb. plus compost at 2,000 lb. per acre and a mixture of amonium sulphate and super phosphate at 1 : 1 ratio at 2 lb. for every pound of seed sown, (3) treating the seed with salt solution, (4) sowing at 1½ lb. of seed per cent of nursery, (5) applying a second dose of manure equal to the first dose after sowing, (6) manuring the transplanted field with 20 cart loads of farm yard manure plus 30 lb. phosphoric acid as basal dressing and 15 lb. nitrogen and 15 lb. P_2O_5 in the form of ammonium sulphate and superphosphate respectively 30 days after planting and another similar dose 30 days after, and (7) transplanting in rows with a spacing of 10″ × 10″ and interculturing with rotary weeder at intervals of 15 days till two weeks before flowering. The farm method consisted of: (1) manuring the wet seed bed with 10,000 lb. of green

manure per acre, (2) using 3 lb. of seed per cent of nursery, (3) manuring the transplanted field with a basal dressing of 5,000 lb. green leaf per acre and 30 lb. P_2O_5 as superphosphate at the time of last ploughing and 30 lb. nitrogen as ammonium sulphate 3 to 4 weeks after transplanting and (4) transplanting 6″×6″ bulk. The varieties PTB 2 and PTB 9 in the first crop and PTB 18 and PTB 20 in the second crop were under trial. The data are presented in Table I.

TABLE I

Size of sub plot 30'x25'
Lay out 4x8 Randomised.

Treatments	1st crop	2nd crop
1. Japanese method	PTB 2	PTB 18
2. Farm method	PTB 2	PTB 18
3. Japanese method	PTB 9	PTB 20
4. Farm method	PTB 9	PTB 20

First Crop.

	PTB 2 (Jap) 1	PTB 2 (Farm) 2	PTB 9 (Jap) 3	PTB 9 (Farm) 4	G. M.	S. E.	"Z" Test satisfied or not	C. D.
Grain Yield in lb.								
Acre yield								
1953—54	2843	1818	2654	1578	2253	102·25	Yes	213
1954—55	3031	2516	1951	1940	2359	96·25	Yes	200
1955—56	2777	2464	2500	2142	2471	73·67	Yes	217
% on G. M.								
1953—54	127·9	81·8	119·4	70·9	100	4·60		9 6
1954—55	128·5	108·7	82·7	82·2	100	4·08		8·5
1955—56	112·4	99·7	101·2	86·7	100	2·98		8·8

Conclusion:

1953—54 1 , 3 , 2 , 4

1954—55 1 , 2 , 3 , 4

1955—56 1 , 3 , 2 , 4

Straw Yield in lb.

	PTB 2 (Jap) 1	PTB 2 (Farm) 2	PTB 9 (Jap) 3	PTB 9 (Farm) 4	G. M.	S. E.	"Z" Test satisfied or not	C. D.
Acre yield								
1953—54	3330	2094	2436	1447	2327	90·8	Yes	189
1954—55	5779	3644	4428	2766	4155	274·0	Yes	814
1955—56	3376	4539	2768	3283	3492	100·9	Yes	296
% on G. M.								
1953—54	143·1	90·0	104·7	62·2	100	3·9		8·1
1954—55	139·1	87·7	106·6	66·6	100	6·6		19·6
1955—56	96·7	130·0	79·3	94·1	100	2·8		8·5

Conclusion:

1953—54 1 , 3 , 2 , 4

1954—55 1 , 3 , 2 , 4

1955—56 2 , 1 , 4 , 3

TABLE I (*Contd.*)

Economics of Cultivation.

	PTB 2 (Jap)	PTB 2 (Farm)	PTB 9 (Jap)	PTB 9 (Farm)
	Profit per Acre.			
1953—54	Rs. 360—6—0	221—4—0	298—4—0	144–12—0
1954—55	,, 335—9—0	266—2—0	140–14—0	161—4—0
1955—56	,, 62–14—0	208—6—0	4—6—0	136–11—0

Second Crop.

	PTB 18 (Jap) (1)	PTB 18 (Farm) (2)	PTB 20 (Jap) (3)	PTB 20 (Farm) (4)	G. M.	S. E.	"Z" Test satisfied or not	C. D.
			Grain Yield in lb.					
Acre yield								
1953—54	..	..	FAILED		..	..	..	..
1954—55	2592	2301	3049	2737	2669	64·1	Yes	133·2
1955—56	..	..	FAILED		..	..	..	..
% on G. M.								
1954—55	97·1	86·2	110·4	102·0	100	2·4		4·9

Conclusion :
1954—55 3 , 4 , 1 , 2

Straw Yield in lb.

	(1)	(2)	(3)	(4)	G. M.	S. E.	"Z" Test	C. D.
Acre yield								
1954—55	2783	2265	3281	2403	2684	137·3	Yes	273·1
% on G. M.								
1954—55	103·8	84·4	122·2	89·5	100	6·5		13·6

Conclusion :
1954—55 3 , 1 , 4 , 2

Economics of Cultivation.

	PTB 18 (Jap)	PTB 18 (Farm)	PTB 20 (Jap)	PTB 20 (Farm)
	Profit per Acre.			
1954—55	Rs. 208—8—0	234—1—0	299—6—0	312—7—0

(2) A regular replicated randomised trial was conducted in the first and second crop seasons of 1955 to find out 'the effect of interculture on the yield.' The crop was planted in lines 10″×6″ with 4 seedlings per hole in the plots receiving interculture and 6″×6″ bulk in the normal method. Interculture with double row rice weeder and ordinary weeding were done in different plots planted in lines whereas in the bulk planted plots, hand weeding alone was done. Apart from recording the yield, economics of cutivation were also worked out for each method. Data are tabulated in Table II.

TABLE II

Trial with double row rice weeder.

Lay out: 3x8 Randomised blocks.

Treatments:

1. Planting in bulk 6″x6″ spacing with two seedlings per hole and hand weeding (control)
2. Planting in lines 10″x6″ spacing with 4 seedlings per hole and hand weeding.
3. Planting in lines 10″x6″ spacing with 4 seedlings per hole and double row rice weeder worked every fortnight.

	First crop	*Second crop*
Variety planted	PTB 2	PTB 20
Sown on	23—4—55	5—9—55
Planted on	16—6—55	2-11—55
Harvested on	12-10—55	24—1—56
No. of times the weeder worked	4 times	2 times

Summary of results

First Crop

	1	2	3	G. M.	S. E.	'Z' Test	C. D.
Acre yield in lb.	3086	3370	3243	3234	45·6		138·3
Percentage on control	100·0	109·2	105·1	104·8	1·48	Satisfied	4·48

Conclusion: $\overline{2 \quad , \quad 3}$, 1

Second Crop

	1	2	3	G. M.	S. E.	'Z' Test	C. D.
Acre yield in lb.	2396	1689	1549	1843	72·46		219·8
Percentage on control	100 0	70·46	64·71	77·0	3·28	Satisfied	9·83

Conclusion: 1 , $\overline{2 \quad , \quad 3}$

Economics.

Particulars	Treatment 1		Treatment 2		Treatment 3	
	1st crop	2nd crop	1st crop	2nd crop	1st crop	2nd crop
Yield of grain per acre in lb.	3086	2396	3370	1689	3243	1549
Yield of straw per acre in lb.	4467	3621	4381	3268	4419	3240
Value of produce per acre.	497—6—0	390—0—6	530-12—6	292-12—6	515-13—6	274-10—0
Cost of cultivation excluding interculture or weeding.	114—3—0	115—8—0	116—0—0	118—0—0	116—1—0	118—0—0
Cost of intercultural or weeding.	5-10—0	5—0—0	5-10—0	5—0—0	12—0—0	6—0—0
Total cost of cultivation.	119-13—0	120—8—0	121-10—0	123—0—0	128—0—0	124—0—0
Profit per acre.	377—9—0	269—8—6	269—8—6	169-12—6	387-12—6	150-10—0

(3) During the second crop season of 1955 an experiment was laid out to find out 'the effect of interculture by working rotary weeder and hand rake against the ordinary hand weeding on the yield of paddy' under normal and heavy manuring as per Japanese method Details of experiment and data are given in Table III,

TABLE III
Interculture Experiment on Rice

Lay out: 10 x 4 Rand blocks. Sown on: 5—9—1955

Planting: 10″ x 10″, 4 seedlings per hole. Planted on: 7 & 8—11—1955

Variety planted: PTB 20. Harvested on: 30—1—1956.

Treatment:

1 — 5 Japanese manuring: Green leaf 6,000 lb. per acre.
Cattle-manure 5 cart-loads.
Ammonium Sulphate 100 lb. per acre applied at the time of planting and an equal quantity one month after planting.

6 — 10 Madras manuring: Green leaf 5,000 lb. per acre. Super 150 lb. per acre. } Basal dressing.
Ammonium sulphate 150 lb. per acre — top dressed one month after planting.

Treatments:
1. Interculture by rotary weeder 15 days, 30 days and 45 days after planting.
2. Interculture by hand rake — 15 days 30 days and 45 days after planting.
3. Weeding twice 15 days, and 30 days after planting each followed by one interculture by rotary weeder.
4. Weeding twice only.
5. No weeding and no transplanting.
6. As in (1).
7. As in (2).
8. As in (3).
9. As in (4).
10. As in (5).

TABLE 3 (*Contd.*)

Summary of Results

Grain Yield per acre

Treatments Particulars	1	2	3	4	5	6	7
Acre yield in lb.	679	752	705	862	745	631	704
Percentage on control	83·3	92·3	86·52	105·8	91·4	77·4	88·4
Percentage on general mean	93·7	103·8	97·22	119·0	102·8	87·10	97·18

Treatments Particulars	8	9	10	G. M.	S. E.	'Z' test C.D.
Acre yield in lb.	669	814	671	724	36·9	Not satisfied
Percentage on control	82·2	100·0	82·4	88·9	4·5	
Percentage on general mean	98·42	112·4	73·5	100·0	5·09	

(4) During the second crop season of 1955-'56 each of the seven strains was planted in lines 12″×6″ in small plots with a view to undertake thorough and easy roguing and purification to serve as nucleus seeds for sowing on the station next year. The yields from these plots were recorded separately and were compared with the yields of the same strains planted in the usual way, i. e., as bulk with a spacing of 6″×6″. The data are presented in Table IV.

TABLE IV

Normal planting vs. planting in lines with wider spacing

Strain No.	Normal planting in bulk 6″ x 6″		Line planting with 12″ x 6″ spacing	
	Area in acres	Yield in lb. per acre	Area in acres	Yield in lb. per acre
PTB 12	3·49	2,809	0·30	3,246
PTB 16	1·14	2,744	0·16	2,608
PTB 18	3·71	1,978	0·26	2,516
PTB 20	4·28	1,040	0·18	511
PTB 21	0·42	2,078	0·26	1,513
PTB 27	3·25	2,727	0·20	2,055
Arikirai culture	1·48	1,447	0·27	1,253

Discussion: The experiment to compare the Japanese method of rice cultivation with the Farm method was conducted for three years since 1953 in the first and second crop seasons. It is seen from the results (Table 1) that in all the four seasons, two seasons having failed, the yields of grain and straw in the Japanese method were

consistently higher than in the Farm method except in the first crop of 1955 when the Japanese method gave less yield of straw than the Farm method. However, the economics show that net profit per acre had often been more with the Farm method than with the Japanese method.

From the results of the experiment with double row rice weeder (Table II) it is seen that no increased yield was obtained due to the working of the implement. The normal method of hand weeding has been found not only to be efficient and economical but also profitable when compared with interculture by double row rice weeder. The crop planted in lines with wider spacing in the first crop with strain PTB 2 has given much higher yield than that planted bulk with normal spacing due to its lodging habit while in the second crop with the strain PTB 20 which does not lodge, the results were reversed, the yield being lower in the crop planted in lines with wider spacing than that planted bulk.

In the interculture experiment (Table III) where all the treatments were planted in lines 10″×10″, the control plot which received normal cultivation, i. e., hand weeding has given the highest yield under both normal and heavy manuring conditions, indicating that interculture by hand rake or rotavator by no means increases the yield.

Finally from the data in Table IV, it was observed that certain strains planted in lines with wider spacing gave higher yields than the same planted in bulk while in certain other strains the position is reversed. It was also noted that PTB 18 planted bulk had lodged partially or totally at different periods after flowering while the strains planted in lines 12″×6″ had not lodged. On the other hand the strains PTB 16, PTB 20, PTB 21, PTB 27 and Arikirai culture had not lodged even at the time of harvest both in bulk as well as in the area planted in lines with wide spacing. The indications are that for the strains which lodge easily, wider spacing may be preferred as in the case of PTB 12 and PTB 18 which have given higher yields when planted in lines with wider spacing. But in the case of strains which do not lodge, closer planting may be adopted to get the maximum yield. It is generally seen that heavy manuring of the rice crop usually predisposes the crop to lodging due to the luxuriant vegetative growth. In such cases planting in lines with wider spacing as followed in the Japanese method of cultivation will be advantageous.

Summary and Conclusion: From the observations and trials briefly described above it is seen that; (1) Excessive manuring for rice crop does not give commensurate profit, (2) Interculture in the standing crop either by rotavators or by hand rake does not contribute to increased yield in rice under Malabar conditions. Ordinary hand weeding is superior to interculture in respect of yield and profit, (3) Planting with wider spacing is advantageous in the case of lodging varieties of rice while closer spacing is to be preferred with the varieties of rice which do not lodge.

ERRATA

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Page 548 Under award of M. Sc. Degrees:

1. In the second line read "there is" as "thesis".
2. Line 5. Read "Biananics" as "Bionomics".

Page 564 Para 1. Line 9. Read "Sum" as "some".

Page 566 Fig. 1. The words "Sprayed" and "Control" to be interchanged.

Regulated Markets in Madras State

by
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It has been recognised that creation of conditions under which the farmer could market or sell his produce with confidence and without any apprehension of being deceived or unfairly treated is one of the most important and potent means ef increasing farm production. Marketing is the final phase of production affording the farmer an apportunity to realise the fruits of his labour. Marketing includes all the activities concerned with the flow of goods and services from producers to consumers such as selling and buying, transport, storage, finance, risk, management, standardisation, grading and the like. Marketing should therefore be considered as a part of the productive process and marketing costs form part of the overall cost of production.

Marketing is the system adopted to dispose the surplus produce. The producer, the middleman and the consumer look upon the marketing process from his own point of view. Marketing is not merely a question of mere holding up for high prices. It is a question of so ordering the entire range of distribution that the benefits of every measure accrues to the person who works on the land and who forms the backbone of the country. Incidently this is bound to confer considerable benefits on the consumers as well. Marketing is a more difficult and complicated job than mere affording of credit facility. The primary producer in this sphere is at present mostly at the mercy or the merchants, Most of our farmers and commission agents own small holdings with meagre resources and slender surpluses for sale. They have very little time to look to marketing and they are not so organised as the purchasers. They labour under many difficulties and are exploited by the purchasers who are resourceful and operate in an organised basis. The manipulation of scales, weights and measures, unauthorised deductions from the price of produce, taking away large volumes of samples from the producer without any payment, absence of market intelligence, lack of transport, lack of financial facilities, the presence of brokers who are not generally fair in their dealings with the growers, price fixation etc; are some of the difficulties which face the simple farmer in the marketing of his produce.

It was under these circumstances that the Royal Commission recommended as early as 1928 the establishment of regulated markets under State legislation. Hyderabad and Bombay were the first to implement the recommentation. Madras passed the legislation as early as 1933. Similar legislation has since been passed in other States as well. The need for extending the benefits of regulated markets to all important centres and crops has also been stressed in the first and second Five Year Plans.

Marketing legislation ensures better facilities for the farmers and traders for buying and selling farm produce and provides for the appointment of a Market Committee. Regulated market merely implies the management of a market through a market Committee on which all interests have adequate representation. The object of regulation of market is the standardization of the market practices and prevention of malpractices which are important from the point of view of development of orderly marketing in the interest of the grower. Regulated market is one of the links in the chain of marketing to provide fair and reasonable price to the grower. Hence this has to be established and operated in such a way that the growers have an effective voice in the management. A regulated market does not interfere with the normal trade but promotes it by providing orderly conditions for marketing. The Market Committee represents both growers and traders. This Committee does not undertake any direct business but only supervises or regulates the transactions of produce for all persons. The main advantages or salient features of regulated markets are given below :—

(i) Market charges are clearly defined and specified, excessive charges are reduced and unwarranted ones are prohibited ;

(ii) Market practices are regularised ;

(iii) Correct weighment is ensured by periodical inspection and verification of scales and weights by licensing weighmen, stamping weights and by supervision ;

(iv) Suitable arrangements are made for the settlement of disputes regarding quality, weighment, deduction etc., with a view to prevent litigation and to safeguard the interests of the seller and smoothen business ;

(v) Insistence on prompt payment of the value of the produce by the buyer and thus helps the poor seller ;

(vi) Reliable and uptodate market news are made available to the users of the markets ;

(vii) Suitable quality standards and standard contract terms for buying and selling can be conveniently enforced in a regulated market ;

(viii) Reliable statistics of arrivals, stocks, prices, etc., are maintained ;

(ix) Various facilities and conveniences are provided in regulated markets such as sheds for the use of the sellers and buyers and for the sale of produce ; such as, space for parking carts, water cistern for cattle ; storage accommodation for agricultural produce ;

(x) Propaganda for agricultural improvement e. g., use of improved seed, adoption of improved methods of cultivation, improved methods of processing and quality improvement by grading of agricultural produce.

The main object of the Act is to provide for the better regulation of buying and selling of commercial crops or any other crop in the Madras State and the establishment of markets for that purpose. The Act as originally enacted in Madras was applicable only to the commercial crops viz. cotton, groundnuts and tobacco. By an amendment made in 1945, Government took powers to declare any other crop as a commercial crop under its provisions. Coconut, Arecanut, Gingelly have been since declared as commercial crops. Within the frame work of the exiting Act, it will be possible to declare all other agricultural produce, including even food crops as commercial crops for purposes of the Act. There is a proposal also to change the name of the Act as Agricultural Produce Markets Act. The Act is enforceable in a specified area in respect of one or more specified crop or crops, after due notification in a prescribed manner. After an area is notified a Market Committee is established. The first Committee is appointed by the Government based on nominations made by departmental officials at the district and State levels. This Committee continues in office for one year in the first instance and if necessary for a second year by an order of the Government. Within this yeriod an elected Committee is brought in. Each elected Committee will hold office for three years. The composition of the Committee is laid down in the Act and provides for a maximum of 12 members, the actual number for each Committee being fixed by the Government. The Act empowers the Government to appoint members to the Committee by nomination, subject to the proviso that the number so appointed does not exceed the number elected. Government have also powers to allocate the number of seats to growers and traders in the Committee. At present five grower members and four trader members are elected and two members are nominated by Government to represent special interests or to rectify defects among the elected personnel. The District Agricultural Officer of the district is an ex-officio member.

The representatives of traders are elected by a constituency made up of persons licenced under Section 5 of the Act and persons registered as buyer or sellers or buyers and sellers for a period of not less than one year. The growers' constituency is made up of the entire set of growers of the commercial crops within the notified area and follows the system as that of Panchayats or Municipalities or District Boards etc. It has also been suggested that the election procedure for the grower constituency is far too elaborate and excessively costly and that the system of elections can be done away with in favour of one providing for appointments by Government.

In the administrative sphere each Market Committee is autonomous subject to the guidance of the Director of Agriculture through the State Marketing Officer. The Committee frames its own bylaws. Fort his purpose a set of model bylaws has been framed for the purpose of

ensuring uniformity. The bylaws of the Committee are required to be approved by the Director of Agriculture. Government have framed the General Rules, the Madras Commercial Crops Markets Rules 1948, the Election Rule 1940 etc. Subject to these Rules, the Market Committees are free to run the administration.

The Market Committees are required to set up regulated markets at specified places by a direction of Government. In actual practice the chief places for regulated markets are notified by Government at the time the Committee is formed. Subsequently the Committee is free to propose additional places for markets for acceptance by Government. The regulated markets are set up in rented or leased premises to start with. As the Committee acquires funds through accumulations in its reserves out of current income obtained by way of levy of fees and licence fees it goes in for owning markets. The funds for this purpose are also obtained by raising loans from Government. Due to want of sufficient finance there is delay in the setting up of regulated markets which is sometimes adversely commented. It has been suggested that regulated markets might function right from the time the Committee is formed and the Government grant long term loans or grants for the purpose.

Right from the time an area is notified under the Act and a Committee is established, all persons engaged in the trade of the notified commercial crop should take out licences as below:

(a) A licence under Section 5 (1) of the Act in respect of places used for buying and selling;

(b) A licence under Section 5 (3) for the places used for storing, weighing, processing etc.

The Collector of the district concerned is the licensing aulhority.

In addition to these licences the Market Committee is allowed to licence all weighmen and brokers in the market. Persons without the licence are not allowed to function as either weighmen or brockers. Till recently all traders (buyers or sellers or buyers and sellers including commission agents) were required to get themselves registered in the Committee and unregistered persons were not allowed to trade. As this provision has been held void by the High Court a consequential amendment of the concerned rule (rule 37) has been made.

The Market Committees are also allowed to levy a fee or cess on the commercial crops bought and sold within the notified area subject to the proviso that the cess is allowed to be collected only once in the course of a chain of buying and selling and to the further restriction that it is not payable to more than one market Committee. Maximum rate of levy in this manner is prescribed in the rules. Usually quantities in small lots purchased by individual consumers are exempt from this levy.

Regulated markets are now working in seven districts in respect of six commercial crops under the Madras Commercial Crops Markets Act 1933.

Details of coverage in respect of each are given below :

Name of Crop	Area in acres			Producton in tons		
	Total in the State	Area covered by regulated Markets & %		Total for the Staie	Quantity covered by the Regulated Markets & %	
Cotton	881,050	690,791	78·4	298,080	239,990	80·5
Groundnut	1938,172	1184,152	61·1	773,390	454,810	58·8
Gingelly	438,457	41,729	9·5	45,300	4,430	9·8
Coconut	559,367	455,709	81 5	1192554000 (numbers)	93132000 (numbers)	71·1
Tobacco	54,690	33,609	61·5	24,010	15,750	65·6
Arecanut	114,727	111,682	97·3	33,600	32,600	98·0

The districts where Market Committees are established and the provisions of the Madras Commercial Crops Markets Act 1933 are enforced are as below :

1. Coimbatore Market Committee : Cotton, Groundnut & Tobacco
2. South Arcot Market Committee : Cotton, Groundnut & Gingelly
3. North Arcot Market Committee : Groundnut
4. Malabar Market Committee : Coconut, Arecanut
5. South Kanara Market Committee : Coconut and Arecanut
6. Ramanathapuram Market Committee : Groundnuts & Cotton
7. Tirunelveli Market Committee : Cotton

The progress of work in the regulation of markets for commercial crops has been made complicated and taxing due to the very many legal issues brought in by many interests; stifling the enforcement of the Act. But the working of this Act in South Arcot district is a good testimony and the people of South Arcot and its Committee deserve all congratulations. There are nine regulated markets which deal in groundnut mainly. Arrivals of groundnut kernels are voluntary and nearly 90% of the produce of about 8,50,000 bags of kernels come to the yard. These markets are very popular with ryots as they secure the best prevailing rates. These markets in South Arcot are the best among regulated markets in the State and perhaps in India.

In conclusion, agricultural marketing on scientific lines should be considered necessary in the development of rural economy of our country in which agriculture is the main stay. The economic well being of the ryot mainly rests in the disposal of his produce in regulated markets at reasonable rate. The producer should get his legitimate share of the price paid by the consumer for his produce. Regulated market is one way ofaffording the farmer to realise it. It is hoped that the objects of regulated markets will be fully understood by all people and the extension of this Act will be welcomed to all the important crops in all the districts of this State soon.

Depth of Placement of Potato Seed Tubers: Its Influence on Yield

In potato planting, the correct placement of seed tubers in the soil is very important. If placed very near the surface soil, the tubers are liable for 'greening' and 'sun-burn'. Besides, they may be easily picked up and eaten by foraging rodents. The eyes that are not in direct contact with the soil may fail to sprout and develop. The tubers are further likely to be washed down the slopes over which potatoes are raised on the Nilgris, if heavy rains occur soon after planting. Hence the depth of planting should be such as to offer the maximum guarantee against losses by the factors cited.

The practice in Florida, one of the main potato-growing centres of the U. S. A. is to place the seed at a depth of one to two inches below the soil surface. Studies in that region by Pifield (1) revealed that such shallow planting resulted in higher yields in years of adequate soil moisture than during dry periods and that depth of planting was not related to yield. But Hardenberg (2) obtained increased yields and less sun-burn by adopting a depth of two to three inches in light soils. Lorenz (3) secured higher total yields with four to six inches depth than with nine inches. Moore (4) found out that deep planting speeded the rate of come-up as a result of the greater and better distribution of soil moisture in the lower regions. In view of the widely-divergent conclusions obtained by workers outside, trials were conducted at the Agricultural Research Station, Nanjanad, during two crop seasons in the years 1949 and 1950, to prescribe the optimum depth for planting potatoes under Nilgiri conditions. The results of these studies are presented in this note.

Four levels for depth of placement (two, four, six and eight inches) were provided in randomised replicated plots, in the trial on the second crop of 1949, while these were increased to five for the one on the main crop of 1950, by the addition of an extra treatment employing placement at ground level. The results are summarised below:

Depth of planting	Acre yield of tubers in lb. Second crop (1949)	Acre yield of tubers in lb. Main crop (1950)
A. Ground level	Not tried	6,300
B. Two inches	3,000	7,000
C. Four inches	3,500	9,600
D. Six inches	3,700	11,600
E. Eight inches	4,400	7,000
S. E. on General Mean	358	1,201
C. D. at 5% level	814	2,612
'F' test	Satisfied	Satisfied
Conclusion:	E, D, C, B,	D, C, B, E, A.

For the second crop of 1949, the highest yield was recorded by placement at eight-inch depth (E) and this was significantly higher than those returned by the four-inch and two inch depths of placement (C and B). Placement at six-inch depth (D), however, was equal in value to that at eight-inch depth (E).

For the main crop of 1950, placement at six-inch depth (D) recorded the highest yield, which was equal to that of four-inch depth (C), but significantly higher than those from the other three treatments E, B and A.

For both the above seasons, no other treatments had recorded significantly higher yields than treatment D (placement at six-inch depth). It was therefore concluded that, for local conditions, a depth of six inches may be considered as optimum for planting.

It was also observed in the main crop (1950) that vigour of growth, as reflected by height, was maximum for six-inch depth of planting. The rate of tillering exhibited no striking differences among the treatments. 'Sun-burn' was definitely the least for six-inches and eight-inch depths, showing a steadily progressive increase for the treatments planted nearer the soil surface.

The data presented pertain to the work done on the subject in the years 1949 and 1950 and were collected from the related reports and records. The studies were conducted under the guidanee of K. Hanumantha Rao and P. Uthaman, who were the Superintendents of the Station during the above years and this is greatefully acknowledged.

Agrl. Research Station, Nanjanad.

K. SAPTHARISHI and M. D. AZARIAH

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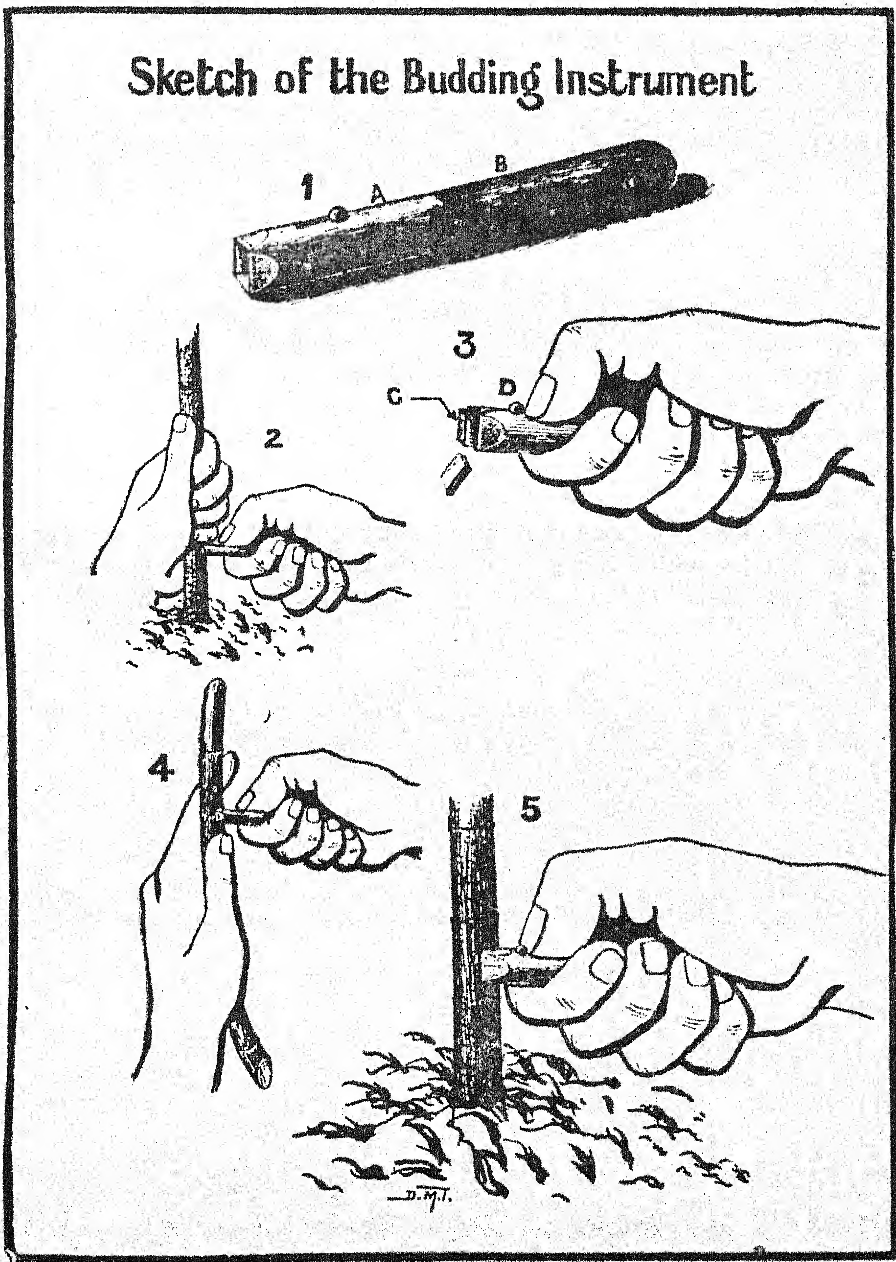
An instrument to facilitate the "patch" bud method of vegetative propagation

Patch budding is employed in the Government Cinchona Plantations in the Madras State on a large scale for propagation of Cinchona. One of



the major steps involved in the process is the removal of a rectangular patch of bark from the rootstock and replacing it with a patch of identical size with a dormant bud attached to it taken from the scion shoot. In normal practice, the budding operation is usually done with a knife. In 1954 an instrument for doing this operation expeditiously and efficiently was devised by Sri R. Veeraraghavan, when he was attached to the Propagation Section of the Madras Cinchona Department.

This consists of an iron cylinder A, 5½ cms. long, with a wooden handle B, 8 cms. long attached to it. The tubular cylinder ends in a rectangular face 10 mm. x 7 mm. with sharp bevelled edges. A strip of iron C, 8 mm. high and 6 mm. boad is fitted inside the cylinder and can be moved in its casing by a knob – D. When pushed forwards fully, the iron strip protrudes 3 mm. beyond the face of the casing, and when fully drawn in retracts to 5 mm. inside. The total length of the instrument is 12 cms. The method of operating this instrument, is as follows: To start with, the iron strip is drawn in and the face of the instrument, with the longer edges parallel to the plant, is placed and pressed square on the rootstock stem where the bud-insertion is to be made so that a rectangular piece of bark is cut and held at the mouth. The bark patch is ejected from the instrument by pushing the strip forward with the knob. The bud is removed in a similar manner from the scion-shoot and placed against the rootstock where the patch has been removed and the iron strip is moved forward so that the bud is pushed into position on the rootstock. This concludes the budding operation, after which the tying operation is carried out as usual. The several steps can be clearly made out from the illustrations.

A trained propagator can do about 200 bud insertions in a day of 8 hours by the use of the instrument, as compared to only about 100 with the knife. An automatic but exact fit of the bud on the rootstock can also be ensured with it. In trials to determine the relative success with the instrument and with the knife, almost the same percentage of success, ranging from 82 to 85 has been secured.

The instrument has however the limitation that it can be used only with shoots which are quite straight and are of at least pencil thickness.

The instrument costs about Rs. 2/- to manufacture and is easy to make.

Government Cinchona Plantations,
Anamallai, Cinchona P. O.

M. MOHAN RAO

Gleanings

Soil Conservation Scheme in Ketty Valley: Ketty valley, situated at an average elevation of about 6,400 feet above mean sea level, is one of the most exploited areas of Nilgiris District. It is shaped like a bowl with hillocks all around and the depression in the centre. The valley extends over an area of 13·5 square miles i. e. nearly 8,640 acres of which about 5,000 acres are generally under cultivation with food and non food crops.

The early settlers in the valley who migrated from the adjoining Mysore plateau had cleared the land of all forests and natural sholas, and broken open the land for cultivation purposes which was generally of the shifting type. This once fertile valley was since then continuously cleared of the natural vegetation, and the shifting cultivation, that was practiced in the early days gave place later on to the cultivation of potato which is a cash crop in the Nilgiris. The improper land use and defective cultural practices for the farming of very steep slopes, growing potato, an erosion permitting row crop year after year in the same land and cultivating up and down the steep slopes, combined with the hilly topography of the area and the heavy rainfall the region receives, have been causing severe erosion of the rich top soil and heavy loss of the available plant nutrients from the cultivated fields. The mechanical loss of the soil caused by erosion could be clearly seen from the silt laden muddy streams flowing in the valley and similarly the deterioration of the fertility of the soil could be assessed from the gradual reduction in the crop yield and the increased requirements of fertilisers needed for maintaining even this reduced yield in such severely eroded lands.

The soils encountered in the valley are clay, clay-loam and loam and are lateritic in origin, with geneissose rock or charnokite as the parent material. The soils have, on analysis, been found to be acidic in nature and deficient in plant nutrients. The area receives an annual rainfall of about 55 inches on an average, of which 26 inches fall on the bare fields left fallow, during three months from October to December in the North East Monsoon period. This is the critical period when most of the soil erosion takes place in the area. The slopes of land range from 1 in 6 at bottom of the valley to 1 in 1 and more towards the ridge.

In order to prevent the erosion of the soil in these steep slopes and to improve and maintain its fertility status, the Agriculture Department of the Government of Mrdras has undertaken the execution of suitable soil conservation works over an area of about 500 acres in Ketty valley. In cultivable lands having slopes from 1 in 6 to 1 in 3 bench terracing with disposal drains and in prohibitive slopes steeper than 1 in 3, contour trenching and planting trees of economic value like blue gum and wattle, are the measures adopted. The vertical intervals between the terraces are fixed with reference to the slope of the land and the depth of soil, so as to get an average working width of at least 10 feet that the ryots require for cultivating potato. As all the cultural operations are carried out in this part of the district only by manual labour, the average width of 10 feet of terraces provided are found to suit the ryots adequately. An inward fall of 1 foot and a longitudinal slope of 1 in 120 are given in the terraces, so as to collect the rain water falling on each of them, and drain it at a non-erosive velocity into safe outlets, excavated at intervals. The length of the terrace is also limited to 400 feet in order to avoid the water stagnating on the terrace for a long time, as the potato crop requires a quick drainage, for a sturdy growth.

While excavating the earth from the hill slopes for forming the bench terraces, the sub soil in the area gets inevitably exposed. But it does not adversely affect the crop yield, as the soil is highly responsive to the heavy manuring which is applied for the potato crop.

These soil conservation measures, besides preventing the erosion of top soil and improving its fertility, have also contributed to some extent, to prolong the useful life of the reservoir capacity of the hydro electric and irrigation projects of lower Kattery Dam and the Lower Bhavani Project constructed lower down of which the Ketty valley forms a catchment. The beneficial results of the soil conservation works have been proved by the increased yield of the potato crop obtained in the terraced fields, to the tune of 40 to 50% over the adjoining unterraced fields, as found from crop cutting experiments conducted and the reduced manurial bills to the beneficiaries. Our ryots who are quick and intelligent to appreciate these benefits, have taken to the soil conservation works so very enthusiastically that the Government have extended these works over a large area of 5000 acres with the ultimate object of covering all the cultivated lands of the Nilgiris District.

The work is done by the Government in the ryots' fields on scientific lines with specially trained officers in soil conservation practices. Manual labour and earthmoving agricultural machinery like tractor, bull dozers are employed for the work. The entire cost of the works amounting to about Rs. 300/- to 400/- an acre is initially borne by the Government. Out of this 75% is recoverable from the beneficiaries in fifteen or twenty easy annual instalments as fixed from time to time, the other 25% being subsidised by Government. This expenditure that the ryot incurs for the permanent improvement to his field is recouped within two years by the increased yield from his land. The maintenance of the works is undertaken by the Government for a period of one year after completion and handed over to the owners of the land thereafter. Follow up agronomic practices, conducive to proper soil conservation practices and to ensure sustained yields from the terraced fields, viz. contour cultivation; crop rotation, green manuring etc. are advocated by the Government.

It is hoped that the importance of soil conservation measures will be realised by a greater number of farmers, especially by those belonging to the hilly regions like the Nilgiris where the erosion menace is acute and the present golden oppurtunity afforded by the Government to undertake suitable soil conservation measures on proper lines will be availed of by the owners of such lands in the best manner possible. MANL.

Calapogonium as Green Manure Cum Cover Crop for the Coconut Garden: Regular green manuring and cultivation of the coconut garden brings about remarkable improvement in the yield of coconuts. Among the various green manure crops grown under the coconut, the legume *Calopogonium mucunoides* is about the best because, besides giving about 10,000 to 20,000 lb. of green stuff per acre, it also acts as a cover crop spreading quickly over the entire soil surface, effectively suppressing weed growth and preventing soil erosion. If the crop is left in the field without being ploughed in, the plants dry up shedding all the leaves. A leaf mulch 4-6 inches thick is thus formed. This is very useful in conserving soil moisture during the dry summer months.

The Calapogonium crop is raised by sowing 8 to 15 lb. of seed broadcast during April - May after receipt of soaking summer showers. Within about three months after germination, the crop attains good vegetative growth spreading over the entire area. Weeds and grass are suppressed. The entire crop may be ploughed in during August, September. But this practice will necessitate sowing of the crop every year. A better method is to allow the crop to dry and shed the leaves and seeds. This ensures a leaf mulch so necessary during the summer months. Also a quick growing self sown calopogonium crop comes up, with the receipt of summer showers in April - May next year. Only, the leaf mulch should be broken up and the seeds evenly distributed and covered by a ploughing prior to the receipt of rains.

The application of fertilisers and ash and cultural operations may be carried out according to one or the other of the following two methods, when the Calopogonium crop is left in the field without being ploughed in. (i) A four to six feet strip on either side of the rows of coconut trees may be dug up in the August - September, the manures applied and worked in as and when necessary (ii) the Calopogonium crop in alternate interspaces between rows of coconut trees may be ploughed up in August - September and the scheduled manuring and cultivation given. The Calopogonium crop in the portions left unploughed may be given a lopping when the first formed seeds are dry enough and the loppings spread over the ploughed area. The ploughing in of the crop, manuring and cultivation may be alternated with retention of the crop for the same area from year to year. The ploughed area will also have a self sown crop of Calopogonium in the succeeding year from the seeds that are shed from the loppongs.

The growing of Calopogonium in coconut garden as described above involves very little extra cost but bostows the advantages of a green manure cum cover crop, provides a leaf mulch in summer, markedly suppresses weed growth and propagates itself from year to year. It does not also obstruct the normal manurial and cultural operations in the coconut garden. MANL.

Long Staple Karunganni Strain: The Indian Central Cotton Committee had recommended that the possibility of evolving a long staple Karunganni strain with 1-1/32" of fibre length (1·03") should be investigated by this State. Work under the Karunganni Improvement Scheme at Kovilpatti has resulted in the isolation of a new high yielding strain (No. 7704) fulfilling this standard. The mean performance of this strain during the last two seasons (1954–'55 and 1955–'56) as compared to two control varieties K. 2. and K. 5. is summarised below. The new strain is appreciably finer as well.

Strain	Kapas yield lb./acre	Ginning %	Mean Fibre length inch.	Mean Fibre Weight Millionth oz. inch	Maturity %	Fibre Strength index
7704	649	31·3	1·05	0·159	84	8·2
K.2.	476	31·8	0 96	0·184	83	8·5
K.5.	507	30·7	0 95	0·191	90	8·3

The adaptability level of this new long staple strain has now been arranged to be tested on cultivators holding during 1956–57 and a total of 22 trials have been programmed in the districts of Tirunelveli, Ramanathapuram, Madurai, Coimbatore and Tiruchirapalli.

Toned milk is best for Madras diet: Toned milk is pure fresh buffalo's milk to which a certain quantity of skimmed milk is added in order to reduce the fat percentage to that of cow's milk, the other constituents of milk remaining the same. It has been exprimentally proved by the Bio-chemistry Department of the University of Madras that this toned milk is equivalent in nutritive as well as biological values to cow's milk. In fact toned milk has shown better growth response with poor Madrasi diet than fresh cow's milk.

Toned milk is exclusively used by the Land, Air and Naval Forces of the Indian Army for more than ten years now. It is very popular in the City of Bombay. All State hospitals in the city are using toned milk at present.

Toned milk is now manufactured at the Government Milk Factory, Teynampet, with the help of modern machinery. The whole process including pasteurisation is mechanised and the milk is untouched by hand from beginning to end.

It provides a cheep source of good quality, safe milk, of equal value to cow's milk. In a tropical country like ours there is not so much dearth of fat as of protein. More of protein than of fat is required, and toned milk provides a well balanced milk suited for the tropics.

Students' Corner

The following were held under the auspices of the Students' Club.

1. **Cinema Show:** Ten documentary films, comprising those on Agriculture, Sports, and Social Welfare were screened in front of the club pavilion on 21—11—56.

2. **Addresses:** (i) Dr. B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi, delivered an address on 30—11—1956. Dr. B. N. Uppal, Agricultural Commissioner with the Government of India presided. Dr. K. C. Naik, Principal, in his welcome speech, emphasized the need for opening a Regional Agricultural Centre, establishing a Rural University and starting a Post Graduate Centre at the Institute. Dr. B. P. Pal traced the development of Research activities at the Indian Council of Agricultural Research and stressed upon the need for team work and perfect co-ordination for the conduct of all research experiments. Dr. B. N. Uppal stated that ample euipment and laboratory facilities would be provided at the Agricultural College and Research Institute for Post Graduate courses. Dr. A. Mariakulandai proposed a vote of thanks.

(ii) Prof. Sharp, Adviser in Agricultural Engineering, T. C. M. and author of the book "Principles of Farm Mechanics", giving his impressions about this country sought to remove the mistaken idea that every one in America was a millionaire. American students were also part-time workers, he said, earning while learning. He exhorted the students to take up the challenge for service, and prepare themselves for being the future pillars of the nation.

Sri V. Rajaguru proposed a vote of thanks.

3. **Club Day Debate Contest:** Was held in advance, on 1—12—56, in all regional languages with the theme. "The poem which I relished much in Literature". Sri Madhava Menon presided.

The prize winners were: Kannada — Sri Ramesh, Malayalam — Sri Sridharan and Tamil Sri C. Gopal. The Secretary, Debating Society, proposed a vote of thanks.

(G. R.)

Weather Review — For November, 1956

RAINFALL DATA (IN INCHES)

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam)	9·1	— 4·9	43·1
	Tirurkuppam*	8·8	+ 1·9	41·5
	Vellore	7·9	+ 0·2	42·4
	Gudiyatham*	4·5	+ 1·4	35·3
East Coast	Palur*	12·3	+ 2·4	49·9
	Tindivanam*	9·6	+ 4·7	42·6
	Cuddalore	17·6	+ 2·1	50·1
	Nagapattinam	18 7	+ 1·2	40·3
	Aduthurai*	16·7	+ 9·4	47·9
	Pattukottai*	10·0	+ 3·0	38·2
Central	Salem	8·6	+ 4·8	45·1
	Coimbatore (A. M. O.)*	10·3	+ 7·2	24·5
	Coimbatore	6·2	+ 2·2	19·0
	Tiruchirapalli	9·2	+ 2·2	37·0

Division	Station	Total rainfall for the month	Departure from normal	Total since 1st January
South	Madurai	11·6	+ 5·9	46·2
	Pamban	13·9	+ 2·2	20·0
	Koilpatti*	9·1	+ 4·1	31·6
	Palayamcottai	3.5	— 3·9	14·4
	Ambasamudram*	9 9	+ 1·7	19·6
West Coast	Trivandrum*	5·2	— 1·8	46·6
	Fort Cochin	9·6	+ 2·9	131·4
	Pattambi*	10·9	+ 7·1	93·8
	Kozhikode	7·7	+ 0·3	129·4
	Taliparamba*	£		
	Wynaad*	10·7	+ 7·3	86·3
	Nileshwar*	£		
	Pilicode*	£		
	Mangalore	2·5	— 1·4	142·5
	Kankanady*	£		
	Kotekar*	£		
Hills	Kodaikanal	13·4	+ 3·2	56·5
	Coonoor*	16·8	+ 6·2	48·8
	Ootacamund*	5·4	+ 1·7	44·6
	Nanjanad*	4 2	+ 1·4	47·4

Note :— 1. * Meteorological Stations of the Madras Agric. Dept.

2. £ Data are not received.

The month began with fairly widespread thundershowers in Madras State. In the subsequent five days from 2—11—56 localised showers were received at a few places in Madras and Kerala States. On 7—11—56, the North-East Monsoon became active over Madras State and rains were consequently fairly widespread in Madras State while they were localised in Kerala State. Under the influence of a shallow depression formed on the morning of 8—11—56 with its Central region about 200 miles east of Madras, rains were localised in Madras State when the weather elsewhere was dry. For six days from 9—11—56 rains were fairly widespread in both the States. On 15—11—56 weather was mainly dry with the exception of a few scattered showers in Madras State. Thundershowers were localised in Madras and Kerala States on 16—11—56. On 17—11—56, the weather again became dry with the exception of a few mild showers in south Madras. The southern portions, particularly the Coastal regions, of Madras and Kerala States had fairly widespread rains on 18—11—56 when the weather in other regions was dry. On 19—11—56, a depression formed in the south-west Bay of Bengal (about 350 miles south-east of Nagapattinam) with the result that the showers were localised in Coastal Madras and at a few places in Kerala. The depression in the Bay of Bengal was close to the coast between Cuddalore and Nagapattinam on 20—11—56 and this was responsible for the fairly widespread rains in Madras and localised showers in Kerala. Showers were localised in Madras and Kerala States on 21—11—56 and on the next day as well with the exception of North Madras, which had fairly widespread rains on 22—11—56.

For two days from 23—11—56 rains were fairly widespread in certain portions of Madras while they were only localised in Kerala. On 25—11—56 weather was mainly dry with exceptions of a very light shower at Cuddalore. Rains were localised in Madras State on 26—11—56 when the weather was dry elsewhere. Thundershowers were fairly widespread in Madras on 27—11—56, when Kerala had only localised showers. In the last three days of the month weather was mainly dry with exception of a few scattered showers at a few places in Madras State.

Considering the month as a whole, except the northern zone of the Madras State, the other areas had fairly good rains throughout. These copious rains improved considerably the water position in the irrigational sources.

The noteworthy rainfall and the zonal rainfall in inches are furnished below :—

Noteworthy Rainfalls			**Zonal Rainfall**			
Date	Place	Rain-fall in inches	Name of Zone	Rainfall for the month	Departure from normal	Remarks
12/11/56	Fort Cochin	3·0	North	7·6	— 0·4	Just below normal
17/11/56	Cuddalore	3·0				
18/11/56	Pamban	5 0	East Coast	14·2	+ 3·8	Above normal
20/11/56	Nagapattinam	9·0				
do	Aduthurai	7·2				
do	Tiruchirapalli	3·0	Central	8·6	+ 4·1	do
do	Salem	3·0				
23/11/56	Madurai	5·0	South	9·6	+ 2·0	do
do	Alleppey	3·0	West Coast	7·8	+ 2·4	do
24/11/56	Tuticorin	5·0	Hills	10·0	+ 3·1	do

Note: * Data from nine stations only are considered.

Agricultural Meteorology Section,
Lawley Road P. O.,
Coimbatore, 11—12—1956

C. B. M. & M. V. J.

Departmental Notifications

Gazetted Officers—Postings and Transfers.

Names and present post	Posted as
Krishna, C. S., Asst. in Cotton (on leave)	Asst. Cotton Specialist and posted as Gazetted Asst. to certificateion Officer, Rajapalayam.
Kuppuswami, B. S., Asst. Fruit Specialist, Coonoor	Agronomist, Coffee Board.
Kothandaraman, S. E., Agl. Eng. Supervisor, Madras	Asst. Agrl. Engineer, Inspection, Madurai.
Lakshmanan, T. S., Asst. in Chemistry	Asst. Agrl. Chemist, Coimbatore.
Murthy, P. A., Agrl. Eng. Supervisor	Temp. Asst. Agrl. Eng. (Scheme) Gudalur.
Mohamad Basheer, Lec. in Entomology	Government Entomologist, Coimbatore.
Muthuswami, P. N., A. D. Pollachi	Temp. D. A. O. Tanjore.
Rajaratnam Chetty, S. D. A. O. (on leave)	Addl. Supdt, Central Farm, Coimbatore.
Ramasubba Iyer, A. K., Spl. D. A. O. Tanjore	Spl. D. A. O. Nagerkoil.
Shanmuga Sundaram, A. Supdt. A. R. S. Palur	Asst. Pady Specialist, Coimbatore.
Saptharishi, K., Supdt. A. R. S. Nanjanad	Deputed to Ceylon to Study the Jaffna Method of Cultivation of Tobacco.
Santhanakrishnan, R., D. A. O. Tirunelveli	D. A. O. Vellore.
Thandavarayan, K., Temp. Addl. Supdt, Central Farm, Coimbatore	Superintendent, A. R. S. Palur.
Thandayutham, K., Asst. Agrl. Eng. (Soil Conservation Scheme) Gudalur	Asst. Agrl. Eng. (Soil Conservation Scheme), Kodaikanal.
Venkataraman, A., D. A. O. Tanjore	D. A. O. Tirunelveli.

Upper Subordinates.

Names and present post	Posted as
Charles Rathnaswami, M., Millet Asst. Coimbatore	Asst. in Tobacco, Bhavanisagar.
Daniel, K. V., Manjakuppam	A. D. Aduthurai.
Mohamad Kunhi Muliar, Kasargode	Extension Officer in Agrl. Vadipatty.
Ramankutty, N. N., Tiruvengad	Extension Officer in Agrl. Madurai.
Swaminathan, R. Kovindanpalayam	A. D. Ariyalur.
Thomas, P. G., Madras	A. D. Tiruchendur.

DISTRICTS
S. ARCOT; COIMBATORE
MALABAR; S KANARA
RAMANATHAPURAM
TIRUNELVELI
NORTH ARCOT

MARKET COMMITTEES CHRONICLE

DEVOTED TO A FACTUAL RECORD OF SERVICE FOR REGULATED MARKETING

CROPS
COTTON; GINGELLY
GROUNDNUT
COCONUT
ARECANUT
TOBACCO

Review of Market Conditions of Commercial Crops in the Areas of Market Committees for the Month of October, 1956.

Cotton: (In this Section: Candy = 784 lb. Pothi = 280 lb.)

Cotton Stocks and Prices: Tirupur: Lint: The market opened with a stock of 9034 candies of Cambodia lint and 1018 candies of Karunganni lint at the beginning of the month. Arrivals during the month came to 3103 candies of Cambodia and 29 candies of Karunganni lint, including 550 candies of Cambodia and 19 candies of Karunganni lint produced from ginneries. Despatches in the month accounted for 3643 candies of Cambodia and 203 candies of Karunganni lint which include 169 candies of Combodia lint sent to Madurai, Calcutta, Travancore-Cochin State and Bombay leaving a closing balance of 8494 candies of Cambodia and 844 candies of Karunganni lint at the end of the month. Prices ranged around Rs. 826/-per candy.

Kapas: The Kapas market opened with a stock of 7818 pothis of Cambodia and 487 pothis of Karunganni. Arrivals amounted to 8278 pothis of Cambodia and 28 pothis of Karunganni. Disposals amounted to 9033 pothis of Cambodia and 114 pothis of Karunganni leaving a closing stock of 7063 pothis of Cambodia and 401 pothis of Karunganni at the close. Prices ranged around Rs. 122/-per pothi of Cambodia.

Koilpatti: Lint: The lint market here opened with a stock of 50 candies of Karunganni. Arrivals in the month amounted to 200 candies of lint from the sorrounding areas, of which 160 candies of Karunganni lint were disposed of leaving a closing stock of 90 candies of lint at the month. The Uganda market opened with a stock of 100 candies with which 300 candies were added by way of receipts. A quantity of 250 candies was moved for pressing leaving a closing stock of 150 candies at the end of the month. Prices fluctuated within a narrow range around Rs. 880/-for Karunganni and Rs. 1100/-for Uganda.

Kapas: There was no transaction of Karunganni kapas in the market during the month. The Uganda kapas market opened with a stock of 1500 pothis and 2000 pothis were received for Sankarankoil area. Disposals in the month totalled 3000 pothis leaving a closing stock of 500 pothis at the end. The market here was more or less maintaining a steady tone and mostly centred round lint. Uganda kapas was quoted around Rs. 130/–per pothi.

Ramanathapuram: Lint: The three markets of Virudhunagar, Sattur and Rajapalayam of this district put together opened with a stock of 2710 candies at the beginning of the month. Arrivals to all these markets totalled 2285 candies of lint while disposals were 1755 candies. The closing stock was 3240 candies. Uganda certified lint was quoted around Rs. 1100/–and uncertified around Rs. 950/–Karunganni was quoted around Rs. 840/–

Kapas: The kapas market in all the three markets opened with a stock of 6450 pothis and 9709 pothis were added by way of receipts. Disposals in these three markets amounted to 11,900 pothis leaving a closing stock of 4250 pothis. Karunganni kapas was quoted around Rs. 110/–and Uganda around Rs. 100/–.

The trading in Karunganni both in lint and kapas in these markets was dull on account of restricted arrivals. The arrivals and transactions in Uganda kapas and lint at Rajapalayam were only moderate due to limited demand in North Indian markets. Harvests of Uganda cotton in Srivilliputhur area had to be postponed as a result of inclement weather.

South Arcot: Kapas: The markets of this district opened with a stock of 50 pothis and 3165 pothis were received during the month of which 3020 pothis was despatched to Coimbatore district. The market closed with a stock of 195 pothis. Prices were fluctuating around Rs. 103/- per pothi.

Groundnuts: (In this section : Candy = 531 lb.
Bag = 80 lb.)

South Arcot District: Stocks: All the markets of South Arcot district opened with a stock of 2014 tons of Kernels at the beginning of the month. Local arrivals amounted to 3418 tons. A quantity of 2011 tons was received from other districts like Coimbatore and North Arcot. Consumption by power mills and country chekkus amounted to 4064 tons and 279 tons respectively. A quantity of 662 tons moved to Tanjore, Salem, and Tiruchirapalli, while 84 tons were despatched to other States like Pondicherry. Deducting a quantity of 185 tons left as wastage, there was a closing stock of 2169 tons at the end of the month. Arrivals of groundnuts declined on account of unfavourable seasonal conditions and the stocks from summer crops having exhausted.

Prices: The average prices of kernels in the several markets of this district ranged from Rs. 135-6-0 to Rs. 150-3-0 per candy depending mainly upon the quality.

North Arcot: Stocks: The markets of this district opened with stock of 105 tons of pods and 155 tons of kernels. Arrivals during the month amounted to 1450 tons of pods and 611 tons of kernels while the off take recorded 904 tons of pods and 625 tons kernels leaving a closing stock of 651 tons of pods and 141 tons of kernels at the end of the month. The harvest of winter crop Groundnut in this district was delayed due to rain till the 3rd week of October. The crops in some places were reported to have been affected by pest at the initial stage of their growth. This coupled with excessive rains received during the earlier part of the month resulted in a poor yield this year. Crushers alone were the main purchasers during the month.

The prices of groundnut kernels have been showing a downward trend at Rs. 150/- per candy as a result of very low prices offered by the buyers anticipating more arrivals in the coming months. The market however, was steady, at this level as the sellers were reluctant to part with their produce. The prices improved during the end of the month to 156 per candy. The prices of oil behaved similarly and ruled at Rs. 300/- to Rs. 310/-.

Ramanathapuram District: The Groundnut market at Virudhunagar had no stocks at the beginning of the month. A quantity of 2960 tons of kernels alone were received during the month which were completely disposed of in the month itself leaving no balance stock. With the local arrivals of new crop pods, receipts from other markets like Pollachi in Coimbatore district declined slightly during the month. The opening and closing prices of groundnut kernels during the month were Rs. 155/- and Rs. 160/- respectively.

Gingelly: (In this Section Bag = 168 lb.)

South Arcot District: Stocks and Prices: The markets of this districts opened with 778 bags of gingelly and 3579 bags and 712 bags were received locally and from other places. Consumption by rotaries and Chekkus amounted to 103 bags and 901 bags respectively. Despatches during the month amounted to 3414 bags mostly to Tanjore, Tiruchirapalli and Madurai districts. There was a closing stock of 651 bags at the end of the month.

Harvest of new crop of gingelly in this district has almost come to a close. The average price in the several markets ruled at Rs. 40-4-0 to Rs. 67-14-0 per bag of 168 lbs. according to quality.

Coconut and its Products: (In this section: Candy = 700 lbs.)

Coconuts: Stocks: The arrivals and transactions of coconuts in the markets of Malabar district were as below in 1000 nuts.

Centres	Opening Stock	Arrivals	Despatches	Local Sales	Closing Stock
Malabar:					
Kozhikode	7209	3000	2300	900	7009
Badagara	1687	8000	9300	7	380
Ponnani	320	750	740	120	210
Tellicherry & Dharmadam	511	1058	1029	25	515

Arrivals of Coconuts are reported to be very low during this period on account of poor yield and quality.

Prices: The prices of Coconuts that ruled in the above markets are given below:—

(Prices in Rs. per 1000 husked nuts)

Malabar:	Maximum.	Minimum.
Kozhikode	137/8	115
Ponnani	126/8	118
Badagara	130/-	110/-
Tellicherry & Dharmadam	135/-	115/-

Copra: The Copra market was dull during the period unlike any other season. The poor yield of coconuts and unfavourable seasonal conditions had their repurcussions in Copra market. The transactions of copra in the markets of Malabar district are detailed below:

(In candies of 700 lbs.)

Markets	Opening Stock	Arrivals	Disposals	Local Sales	Closing Stock
Malabar District:					
Kozhikode	4573	2500	1825	1200	4048
Badagara	1100	3000	3600	320	180

Prices: The prices of copra per candy in Malabar District were as follows:

	Kozhikode		*Badagara*	
Variety	Maximum.	Minimum.	Maximum.	Minimum.
Office	Rs. ... 315	Rs. ... 312	Rs. ... 312/8	Rs. ... 310
Edible	,, ... 312	,, ... 310	No Stock	
Madras	,, ... 305	,, ... 305	,, ... 335	Rs. ... 332/8
Rajpur	,, ... 340	,, ... 335	,, ... 370	,, ... 355

Arecanuts: (in this section: Bag = 100 lbs.)

Heavy arrivals of arecanuts were noted during the month under review as a result of curing taking place in full swing. Despatches were mainly to Bangalore and Panruti. Arrivals totalled 8100 bags bringing the total stock to 10360 bags of which 6500 bags were sold during the month leaving a balance of 3860 bags. The price ranged between Rs. 185—190 per bag in the Kozhikode market.

Tobacco: (In this section: Candy = 500 lbs.)

Stocks: (Coimbatore) The Tobacco market at Tiruppur started with an opening balance of 20055 candies of chewing and 1880 candies of cheroot tobacco at the commencement of the month. About 3505 candies of chewing and 600 candies of cheroot tobacco were despatched during the month to Palghat, Tanjore, Chingleput, Mysore and Andhra. About 20 candies of beedi tobacco are reported to have been obtained in the district from Bombay. At the end of the month, there was a closing stock of 16,550 candies of chewing and 1280 candies of cheroot tobacco.

Prices: The prices of different varieties of Tobacco per candy in Tiruppur market are extracted below:

(Prices in Rupees per candy)

Variety	*I Grade*	*II Grade*	*III Grade*
	Rs.	Rs.	Rs.
I. *Chewing Tobacco—Sun Cured.*			
(a) Meenampalayam	300 — 350	200 — 275	150 — 175
(b) Other Varieties	175 — 275	100 — 175	75 — 100

(Prices in Rupees per candy)

Variety	*I Grade*	*II Grade*	*III Grade*
	Rs.	Rs.	Rs.
2. *Cheroot Varieties:*			
Sun cured (grown in Erode and Bhavani)	230 — 240	170 — 225	110 — 155
3. *Chewing Varieties:*			
Pit cured (grown in Palladam and Sulur areas)	225 — 315	100 — 175	75 — 125

Review of the administrative activities of the Market Committees for October 1956

General: All the Market Committees continued to function under Section 6 (A) of the Madras Commercial Crops Markets Act except Coimbatore Market Committee and Malabar Market Committee which are functioning under an elected body. The stalemate caused in the Market Committees of Tirunelveli and Ramanathapuram Market Committee continues awaiting the judgment of the Supreme Court.

The following are the progress made in the issue of licences by the Market Committees in the State :

	Section 5 (1)		Section 5 (3)		Weighmen	
	A	B	A	B	A	B
North Arcot Market Committee	594	1782	262	947	129	550
South Arcot Market Committee	219	2111	196	1793	188	1660
Coimbatore Market Committee	48	879	51	943	24	620
Tirunelveli Market Committee	Nil	13	Nil	16	Nil	7
Ramanathapuram Market Committee	Nil	29	Nil	28	Nil	5
South Kanara Market Committee	35	181	7	69	Nil	57
Malabar Market Committee	12	408	33	1531	Nil	Nil

A : During the month. B : Upto end of the month from January 1956.

A = During the month.

B = Upto the end of the month from January 1956.

Meetings: A meeting of the Coimbatore Market Committee was held on 15th October at Tiruppur. Among the important subjects discussed, the Committee evolved a draft agreement for enabling the Co-operative Sales Society, Tiruppur to function in the premises of Market yard at Tiruppur. As recommended by the Executive Sub-Committee, the Committee approved the Budget Estimates of the Committee for the year 1957. The Committee approved the inclusion of turmeric as a commercial crop. There was no meeting in any other Market Committees during the month.

Quality Appraisal: The South Arcot Market Committee in its Quality analysis work during the month, analysed 158 samples drawn from out of 1753 bags of arrivals of kernels, consisting of 2708 lots. Of the 158 samples analysed Virudhachalam alone accounted for 53 samples which were below 4% in refraction while Cuddalore, Tindivanam and Panruti recorded refraction below 4% in 50% of the samples analysed.